



# CONTINUING (1.53(b)) UTILITY PATENT APPLICATION TRANSMITTAL

(Only for continuing applications under 37 CFR 1.53(b))

Attorney Docket No.

1293.1069D

First Named Inventor:

Hyun-kwon CHUNG et al.

Title:

RECORDING MEDIUM FOR STORING REAL TIME  
RECORDING/REPRODUCTION INFORMATION, METHOD, AND  
APPARATUS FOR RECORDING AND REPRODUCING IN REAL  
TIME, AND FILE OPERATING METHOD USING THE SAME

Express Mail Label No.

## APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent  
application contents.

ADDRESS TO:

Assistant Commissioner for Patents  
Box Patent Application  
Washington, DC 20231

1. ☒ Fee Transmittal Form
2. ☒ Specification, Claims & Abstract ..... [ Total Pages: 39 ]
3. ☒ Drawing(s) (35 USC 113) ..... [ Total Sheets: 11 ]
4. ☒ Oath or Declaration ..... [ Total Pages: 2 ]
  - a. ☐ Newly executed (original or copy)
  - b. ☒ Copy from a prior application (37 CFR 1.63(d)) (see Box 18)
5. ☐ This application is filed by fewer than all the inventors named in the prior non-provisional application.
  - a. ☐ **DELETE** the following inventor(s) named in the prior non-provisional application:
  - b. ☐ The inventor(s) to be deleted are set forth on a separate sheet attached hereto.
6. ☒ Incorporation by Reference (usable if Box 4b is checked)  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
7. ☐ Microfiche Computer Program (Appendix)
8. ☐ Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
  - a. ☐ Computer Readable Copy
  - b. ☐ Paper Copy (identical to computer copy)
  - c. ☐ Statement verifying identity of above copies

## ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☒ Foreign priority benefit under 35 U.S.C. §119 is claimed.
  - a. ☒ Certified Copy of Priority Document(s) filed in prior application No. 09/304,279.
  - b. ☐ Certified Copy of Priority Document(s) enclosed.
  - c. ☐ Certified Copy of Priority Document(s) to follow.
13. ☒ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
14. ☒ Preliminary Amendment
  - a. ☒ enclosed herewith.
  - b. ☐ incorporated herein (see Box 18).
15. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
16. ☐ Small Entity Statement(s) ☐ Statement filed in prior application, status still proper and desired.
17. ☐ Other:

**18. CONTINUING APPLICATION**, check appropriate box and supply the requisite information below:[ ] Continuation [X] Divisional [ ] Continuation-in-part (CIP) of prior application No: 09/304,279Prior application information: Examiner: UNASSIGNEDGroup/Art Unit: 2754

\* \* \*

**Preliminary Amendment:**[X] Cancel in this application original claims 1-37, 63-92 and 94 of the prior application before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)

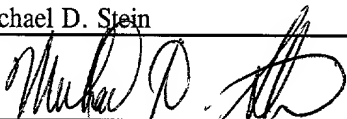
[X] Amend the specification by inserting before the first line the sentence:

--This application is a divisional of application number 09/304,279, filed May 3, 1999, now pending.--**19. NEW CORRESPONDENCE ADDRESS \* CUSTOMER NO. 21,171**STAAS & HALSEY LLP  
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**20. SIGNATURE OF ATTORNEY OR AGENT**

NAME	Michael D. Stein	REGISTRATION NO.	37,240
SIGNATURE		DATE	5/24/00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of:

Hyun-kwon CHUNG et al.

Group Art Unit: unassigned

Application No.: unassigned

Examiner: unassigned

Filed: May 24, 2000

For: RECORDING MEDIUM FOR STORING REAL TIME  
RECORDING/REPRODUCTION INFORMATION, METHOD, AND APPARATUS  
FOR RECORDING AND REPRODUCING IN REAL TIME, AND FILE  
OPERATING METHOD USING THE SAME

**PRELIMINARY AMENDMENT**

Honorable Commissioner of  
Patents and Trademarks  
Washington, D.C. 20231

Sir:

Before examination of the above-identified application, please amend the application as follows:

**IN THE SPECIFICATION**

Page 16,	line 4,	change "Method" to --A method--;
	line 5,	after "file" insert --is performed as follows--;
	line 30,	change "Method" to --A method--; after "file" insert --is as follows--.

Page 18, line 4, change "Method" to --A method--; after "data" insert --is performed as follows--;

line 19, change "a" (first occurrence) to --A--;

line 20, after "driver" insert --203--;

line 21, change "Method" to --A method--; after "data" insert --is performed as follows--.

Page 19, line 25, change "Method" to --A method--; after "file" insert --is performed as follows--;

line 28, after "CloseHandle" insert --function--.

### IN THE CLAIMS

Please cancel claims 1 through 37, 63 through 92 and 94 without prejudice or disclaimer, amend claims 38 through 62 and 93, and add new claims 95 through 141, as follows:

38. (ONCE AMENDED) A recording [and] and/or reproducing method comprising the steps of:

(a) arranging and recording real time files requiring real time recording/reproduction according to real time recording/reproduction in a recording medium according to real time recording/reproduction information for ensuring real time reproduction, and recording the real time recording/reproduction information in the recording medium; and

(b) reading and reproducing the real time files using the real time recording/reproduction information.

39. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the step (a) comprises storing the real time recording/reproduction information in a file control information area of the recording medium.

40. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the step (a) comprises storing the real time recording/reproduction information in a file control information area of a UDF system of the recording medium.

41. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the step (a) comprises storing the real time recording/reproduction information in each corresponding real time file.

42. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the step (a) comprises storing the real time recording/reproduction information associated with the real time files in a separate file from the real time files.

43. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the step (a) comprises storing the real time recording/reproduction information in a volume structure area of the recording medium.

44. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the real time recording/reproduction information includes file indication information indicating that the real time files require real time recording/reproduction.

45. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the real time files have sections with different bit rates, and the

real time recording/reproduction information includes recording/reproduction bit rate information which includes information associated with the sections and a plurality of bit rate values corresponding to the different bit rates of the sections.

46. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 45, the step (a) comprises automatically arranging file data areas of the real time files according to the recording/reproduction bit rate information.

47. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 46, wherein the real time recording/reproduction information includes a maximum allowable value of the real time recording/reproduction bit rates.

48. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the real time recording/reproduction information includes at least one of minimum contiguous storage blocks satisfying a condition in which a playback time of a current data block is greater than a sum of the seek time and a read time of a data block to be played back next, and a playback time for ensuring minimum contiguous storage.

49. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 48, wherein the step (a) comprises arranging the real time files in the minimum contiguous storage blocks.

50. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 48, wherein the step (a) comprises the step (a1) if an end portion of one of the real time files is not filled with data by one of the minimum contiguous storage blocks while the one real time file is recorded in units of the minimum contiguous storage blocks, recording as the real time recording/reproduction information an attribute indicating that a number of data blocks corresponding to a size of the unfilled portion are allocated but unrecorded.

51. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 48, wherein the minimum contiguous storage blocks are classified according to a size of an error correction code block and a maximum seek time.

52. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 51, wherein the step (a) comprises arranging the real time files in the classified minimum contiguous storage blocks.

53. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 48, wherein the real time recording/reproduction information further includes current real time recordable/reproducible state information indicating whether a current file is arranged so as to be recorded/reproduced in real time.

54. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 48, wherein the real time recording/reproduction information further includes contiguous recording/reproduction type information classified by conditions for controlling real time files, the conditions including recording/reproduction bit rate information, file defect management information, file allocation information, file buffering information, and the information of the minimum contiguous storage blocks.

55. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 48, wherein the real time recording/reproduction information further includes at least one of file defect management information indicating that replacement of a defective block with a block in a spare area of the recording medium and rereading or rewriting of the defective block are not attempted when reading or writing has failed, file allocation information indicating that a data block is not allocated to the defective block replaced by the spare area, and file buffering information associated with an amount of data to be initially read from a buffer and an amount of data written from the buffer at a time.



56. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the step (b) comprises the [substeps] steps of:

(b1) reading a volume area on the recording medium; and

(b2) reproducing a file as one of the real time files in consideration of the real time recording/reproduction information if the real time recording/reproduction information exists in the volume area.

57. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 56, wherein the step (b2) comprises analyzing recording/reproduction bit rate information, defect management information, file allocation information, and file buffering information according to the real time recording/reproduction information in the volume area, and reading and reproducing file data in minimum contiguous storage blocks of the file.

58. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the step (b) comprises the [substeps] steps of:

(b1) determining whether the real time recording/reproduction information exists in a file area; and

(b2) reproducing a file in consideration of the real time recording/reproduction information if the real time recording/reproduction information exists in the file area.

59. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 58, wherein the step (b2) comprises analyzing recording/reproduction bit rate information, defect management information, file allocation information, and file buffering information according to the real time recording/reproduction information in the file area, and reading and reproducing file data in minimum contiguous storage blocks.

60. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 38, wherein the method further comprises the step of:

(c) copying a file to a free area from which a defective block is excluded, based upon the real time recording/reproduction information and general defect management information recorded on the recording medium.

61. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 60, wherein the step (c) comprises copying the real time recording/reproduction information and the file together.

62. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 60, wherein the step (c) comprises copying only real time file data based on the real time recording/reproduction information.

93. (ONCE AMENDED) The recording [and] and/or reproducing method as claimed in claim 48, wherein the real time recording/reproduction information further includes current real time recordable/reproducible state information indicating whether it is possible to record/reproduce a current file in real time.

95. (NEW) A recording method comprising the steps of:  
arranging and recording real time files requiring real time recording/reproduction according to real time recording/reproduction in a recording medium according to real time recording/reproduction information for ensuring real time reproduction; and  
recording the real time recording/reproduction information in the recording medium

96. (NEW) The recording method as claimed in claim 95, wherein the recording of the real time recording/reproduction information comprises storing the real time recording/reproduction information in a file control information area of the recording medium.

97. (NEW) The recording method as claimed in claim 95, wherein the recording of the real time recording/reproduction information comprises storing the real time

recording/reproduction information in a file control information area of a UDF system of the recording medium.

98. (NEW) The recording method as claimed in claim 95, wherein the recording of the real time recording/reproduction information comprises storing the real time recording/reproduction information in each corresponding real time file.

99. (NEW) The recording method as claimed in claim 95, wherein the recording of the real time recording/reproduction information comprises the real time recording/reproduction information associated with the real time files in a separate file from the real time files.

100. (NEW) The recording method as claimed in claim 95, wherein the recording of the real time recording/reproduction information comprises storing the real time recording/reproduction information in a volume structure area of the recording medium.

101. (NEW) The recording method as claimed in claim 95, wherein the real time recording/reproduction information includes file indication information indicating that the real time files require real time recording/reproduction.

102. (NEW) The recording method as claimed in claim 95, wherein the real time files have sections with different bit rates, and the real time recording/reproduction information includes recording/reproduction bit rate information which includes information associated with the sections and a plurality of bit rate values corresponding to the different bit rates of the sections.

103. (NEW) The recording method as claimed in claim 102, the recording of the real time recording/reproduction information comprises automatically arranging file data areas of the real time files according to the recording/reproduction bit rate information.

104. (NEW) The recording method as claimed in claim 103, wherein the real time recording/reproduction information includes a maximum allowable value of the real time recording/reproduction bit rates.

105. (NEW) The recording method as claimed in claim 95, wherein the real time recording/reproduction information includes at least one of minimum contiguous storage blocks satisfying a condition in which a playback time of a current data block is greater than a sum of the seek time and a read time of a data block to be played back next, and a playback time for ensuring minimum contiguous storage.

106. (NEW) The recording method as claimed in claim 105, wherein the recording of the real time recording/reproduction information comprises arranging the real time files in the minimum contiguous storage blocks.

107. (NEW) The recording method as claimed in claim 105, wherein the recording of the real time recording/reproduction information comprises, if an end portion of one of the real time files is not filled with data by one of the minimum contiguous storage blocks while the one real time file is recorded in units of the minimum contiguous storage blocks, recording as the real time recording/reproduction information an attribute indicating that a number of data blocks corresponding to a size of the unfilled portion are allocated but unrecorded.

108. (NEW) The recording method as claimed in claim 105, further comprising classifying the minimum contiguous storage blocks according to a size of an error correction code block and a maximum seek time.

109. (NEW) The recording method as claimed in claim 108, wherein the arranging and recording of the real time files comprises arranging the real time files in the classified minimum contiguous storage blocks.

110. (NEW) The recording method as claimed in claim 105, wherein the real time recording/reproduction information further includes current real time recordable/reproducible state information indicating whether a current file is arranged so as to be recorded/reproduced in real time.

111. (NEW) The recording method as claimed in claim 105, wherein the real time recording/reproduction information further includes contiguous recording/reproduction type information classified by conditions for controlling real time files, the conditions including recording/reproduction bit rate information, file defect management information, file allocation information, file buffering information, and the information of the minimum contiguous storage blocks.

112. (NEW) The recording method as claimed in claim 105, wherein the real time recording/reproduction information further includes at least one of file defect management information indicating that replacement of a defective block with a block in a spare area of the recording medium and rereading or rewriting of the defective block are not attempted when reading or writing has failed, file allocation information indicating that a data block is not allocated to the defective block replaced by the spare area, and file buffering information associated with an amount of data to be initially read from a buffer and an amount of data written from the buffer at a time.

113. (NEW) The recording method as claimed in claim 38, wherein the method further comprises the steps of:

recording general defect management information in the recording medium; and  
copying a file to a free area from which a defective block is excluded, based upon the real time recording/reproduction information and the general defect management information recorded in the recording medium.

114. (NEW) The recording method as claimed in claim 113, wherein the copying of the file comprises copying the real time recording/reproduction information and the file together.

115. (NEW) The recording method as claimed in claim 113, wherein the copying of the file comprises copying only real time file data based on the real time recording/reproduction information.

116. (NEW) The recording method as claimed in claim 105, wherein the real time recording/reproduction information further includes current real time recordable/reproducible state information indicating whether it is possible to record/reproduce a current file in real time.

117. (NEW) A reproducing method of a recording medium, wherein real time files requiring real time recording/reproduction according to real time recording/reproduction are stored in a recording medium according to real time recording/reproduction information for ensuring real time reproduction, and the real time recording/reproduction information is stored in the recording medium, the method comprising:

reading the real time files using the real time recording/reproduction information; and  
reproducing the read real time files.

118. (NEW) The reproducing method as claimed in claim 117, wherein the reading of the real time files comprises reading the real time recording/reproduction information from a file control information area of the recording medium.

119. (NEW) The reproducing method as claimed in claim 117, wherein the reading of the real time files comprises reading the real time recording/reproduction information from a file control information area of a UDF system of the recording medium.

120. (NEW) The reproducing method as claimed in claim 117, wherein the reading of the real time files comprises reading the real time recording/reproduction information in each corresponding real time file.

121. (NEW) The reproducing method as claimed in claim 117, wherein the reading of the real time files comprises reading the real time recording/reproduction information associated with the real time files in a separate file from the real time files.

122. (NEW) The reproducing method as claimed in claim 117, wherein the reading of the real time files comprises reading the real time recording/reproduction information in a volume structure area of the recording medium.

123. (NEW) The reproducing method as claimed in claim 117, wherein the real time recording/reproduction information includes file indication information indicating that the real time files require real time recording/reproduction.

124. (NEW) The reproducing method as claimed in claim 117, wherein the real time files have sections with different bit rates, and the real time recording/reproduction information includes recording/reproduction bit rate information which includes information associated with the sections and a plurality of bit rate values corresponding to the different bit rates of the sections, the method further comprising:

reading the sections of the real times files in accordance with the corresponding plurality of bit rate values.

125. (NEW) The reproducing method as claimed in claim 124, wherein the file data areas of the real time files are arranged according to the recording/reproduction bit rate information.

126. (NEW) The reproducing method as claimed in claim 125, wherein the real time recording/reproduction information includes a maximum allowable value of the real time recording/reproduction bit rates.

127. (NEW) The reproducing method as claimed in claim 117, wherein the real time recording/reproduction information includes at least one of minimum contiguous storage blocks satisfying a condition in which a playback time of a current data block is greater than a sum of the seek time and a read time of a data block to be played back next, and a playback time for ensuring minimum contiguous storage.

128. (NEW) The reproducing method as claimed in claim 127, wherein the real time files are arranged in the minimum contiguous storage blocks.

129. (NEW) The reproducing method as claimed in claim 127, wherein if an end portion of one of the real time files is not filled with data by one of the minimum contiguous storage blocks while the one real time file is recorded in units of the minimum contiguous storage blocks, the real time recording/reproduction information is recorded as an attribute indicating that a number of data blocks corresponding to a size of the unfilled portion are allocated but unrecorded.

130. (NEW) The reproducing method as claimed in claim 127, wherein the minimum contiguous storage blocks are classified according to a size of an error correction code block and a maximum seek time.

131. (NEW) The reproducing method as claimed in claim 127, wherein the real time recording/reproduction information further includes current real time recordable/reproducible state information indicating whether a current file is arranged so as to be recorded/reproduced in real time.



132. (NEW) The reproducing method as claimed in claim 127, wherein the real time recording/reproduction information further includes contiguous recording/reproduction type information classified by conditions for controlling real time files, the conditions including recording/reproduction bit rate information, file defect management information, file allocation information, file buffering information, and the information of the minimum contiguous storage blocks.

133. (NEW) The reproducing method as claimed in claim 127, wherein the real time recording/reproduction information further includes at least one of file defect management information indicating that replacement of a defective block with a block in a spare area of the recording medium and rereading or rewriting of the defective block are not attempted when reading or writing has failed, file allocation information indicating that a data block is not allocated to the defective block replaced by the spare area, and file buffering information associated with an amount of data to be initially read from a buffer and an amount of data written from the buffer at a time.

134. (NEW) The reproducing method as claimed in claim 117, wherein the reading of the real time files comprises the steps of:

reading a volume area on the recording medium; and  
reproducing a file as one of the real time files in consideration of the real time recording/reproduction information if the real time recording/reproduction information exists in the volume area.

135. (NEW) The reproducing method as claimed in claim 134, wherein the reproducing of the file comprises analyzing recording/reproduction bit rate information, defect management information, file allocation information, and file buffering information according to the real time recording/reproduction information in the volume area, and reading and reproducing file data in minimum contiguous storage blocks of the file.

136. (NEW) The reproducing method as claimed in claim 117, wherein the reproducing of the file comprises the steps of:

determining whether the real time recording/reproduction information exists in a file area; and

reproducing a file in consideration of the real time recording/reproduction information if the real time recording/reproduction information exists in the file area.

137. (NEW) The recording and reproducing method as claimed in claim 136, wherein the reproducing of the file comprises analyzing recording/reproduction bit rate information, defect management information, file allocation information, and file buffering information according to the real time recording/reproduction information in the file area, and reading and reproducing file data in minimum contiguous storage blocks.

138. (NEW) The reproducing method as claimed in claim 117, wherein the method further comprises the step of:

(c) copying a file to a free area from which a defective block is excluded, based upon the real time recording/reproduction information and general defect management information recorded on the recording medium.

139. (NEW) The reproducing method as claimed in claim 138, wherein the copying of the file comprises copying the real time recording/reproduction information and the file together.

140. (NEW) The reproducing method as claimed in claim 138, wherein the copying of the file comprises copying only real time file data based on the real time recording/reproduction information.

141. (NEW) The reproducing method as claimed in claim 127, wherein the real time recording/reproduction information further includes current real time recordable/reproducible

state information indicating whether it is possible to record/reproduce a current file in real time.

## REMARKS

In accordance with the foregoing, the specification has been amended to improve form and provide improved correlation with the drawings and claims. Claims 38 through 62, 93 and 95 through 141 are pending, claims 38 through 62 and 93 have been amended, claims 95 through 141 have been newly added and claims 1 through 37, 63 through 92 and 94 have been cancelled without prejudice or disclaimer. No new matter is presented in this Preliminary Amendment.

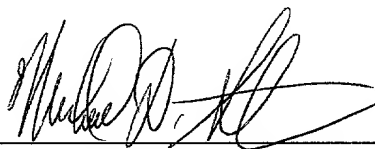
Claims 38 through 62 and 93 have been amended to more particularly point out the subject matter of the present invention and claims 95 through 141 have been added to provide a varying scope of claim coverage. The cancelled claims 1 through 37, 63 through 92 and 94 have been included in some form in other divisional applications.

In view of the foregoing amendments, arguments and remarks, all claims are deemed to be allowable and this application is believed to be in condition for allowance.

If any further fees are required in connection with the filing of this Amendment, please charge the same to our deposit account number 19-3935.

Should any questions remain unresolved, the Examiner is requested to telephone Applicants' attorney.

Respectfully submitted,  
STAAS & HALSEY



Michael D. Stein  
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Dated 5/24/80

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## TITLE OF THE INVENTION

RECORDING MEDIUM FOR STORING REAL TIME RECORDING/REPRODUCTION  
INFORMATION, METHOD AND APPARATUS FOR RECORDING AND  
REPRODUCING IN REAL TIME, AND FILE OPERATING METHOD USING THE  
SAME

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## CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Application Nos. 98-15769, filed May 1, 1998; 98-27308, filed July 7, 1998; 98-30218, filed July 27, 1998; 98-41764, filed October 2, 1998; and 98-55039, filed December 15, 1998 in the Korean Patent Office, the disclosures of which are incorporated herein by reference.

10

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to a system requiring recording and/or reproduction in real time, and more particularly, to a recording medium for storing real time recording/reproduction information, a method and apparatus for recording and reproducing a real time file based on the real time recording/reproduction information, and a file operating method using the real time recording/reproduction information.

15

### 2. Description of the Related Art

In a computer or audio and/or video (A/V) apparatus constituted of a file system for an A/V file required to be recorded/reproduced in real time, control information representing that the A/V file is a real time recording/reproduction file is not recorded in file control information. Thus, it is impossible to reproduce in real time a file comprised of data blocks physically scattered on a recording medium even if they are logically successive.

20

Here, a conventional file system, as shown in FIG. 1, is comprised of file control information having the length of a file, information on the position of file data, information on the possibility or impossibility of reading/writing a file, etc., and file data stored in positions designated by the file control information. When a file on a disc is read, file control information is first read, and file data in the positions designated by the read file

25

control information is then read and reproduced. Such a method of allocating a block of a fixed size used in the conventional file system cannot guarantee real time reproduction of a file.

That is, recording/reproduction of the conventional file system is described by taking  
5 as an example the case in which two files occupy blocks on a disc as shown in FIG. 2. Here, a file A, requiring real time reproduction, occupies blocks 0, 3, 5 and 6 of the disc, and a file B, a general file, occupies blocks 1, 2, 4 and 7 of the disc.

The process for reproducing the file A is as follows.

In the first step, block 0 is read. In the second step, block 3 is searched for. In the  
10 third step, block 3 is read and played back. In the fourth step, the block 5 is searched for. In the fifth step, blocks 5 and 6 are read and played back. In the conventional file system, since information associated with real time recording/reproduction is not recorded even when recording a file requiring real time recording/reproduction, a data arrangement for real time recording/reproduction is not considered. Thus, real time reproduction may not be achieved.

That is, the file A (for example, a video file) of FIG. 2 requires real time  
15 reproduction, but the conventional file system arranges data files without consideration of the requirement of real time reproduction, thus causing a screen to be interrupted during playback. In order to record/reproduce files in real time, the sum of a seek time and a read time must be smaller than a playback time, as shown in the following expression:

20 
$$\text{seek time} + \text{read time} < \text{playback time} \quad \dots(1)$$

In order to prevent a screen from being interrupted, a next block must be searched for during reading and reproducing a current block before the next block is read. However, in an apparatus for driving a disc such as a compact disc (CD) and a digital versatile disc (DVD), the seek time is significantly longer than the read time. Therefore, real time reproduction is  
25 impossible if the next block is not physically adjacent to the current block.

## SUMMARY OF THE INVENTION

To solve the above problems, it is an object of the present invention to provide a recording medium for storing real time recording/reproduction information for real time files.

It is another object of the present invention to provide a method of recording real time recording/reproduction information after real time files are arranged in a minimum contiguous storage block and of reproducing files in real time according to the real time recording/reproduction information.

5 It is still another object of the present invention to provide a method of copying files in consideration of real time recording/reproduction information, adding the real time recording/reproduction information of original files to copied files, and reproducing the copied files in real time using real time recording/reproduction information.

10 It is yet another object of the present invention to provide an apparatus for recording a recording/reproduction bit rate as real time recording/reproduction information, for recording a plurality of recording/reproduction bit rates as real time recording/reproduction information when the recording/reproduction bit rate varies for different data sections, and for reproducing files in real time according to the real time recording/reproduction information.

15 It is still yet another object of the present invention to provide a file operating method of generating a file in which real time recording/reproduction information has been set, expanding data regions, recording and reproducing the file, and performing other file operations.

20 Additional objects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

25 Accordingly, to achieve the above and other objects of the present invention, there is provided a recording medium in which real time files requiring real time recording/reproduction are recorded, wherein real time recording/reproduction information for ensuring real time recording/reproduction of the real time files is stored in a file control information area.

30 To further achieve the above and other objects of the present invention, there is provided a recording and reproducing method comprising the steps of: (a) arranging and recording real time files requiring real time recording/reproduction on the basis of real time recording/reproduction information for ensuring real time reproduction, and recording the

real time recording/reproduction information; and (b) reading and reproducing the real time file data using the real time recording/reproduction information.

To still further achieve the above and other objects of the present invention, there is provided a recording and reproducing apparatus for recording and/or reproducing real time files on a disc using real time recording/reproduction information for ensuring real time recording/reproduction, the apparatus comprising: a codec for compressing and encoding an input bitstream according to a predetermined compression scheme and providing compressed data upon recording, and decoding the compressed and encoded data upon reproduction; a buffer for temporarily storing the compressed data at a recording bit rate using bit rate information included in the real time recording/reproduction information, and transmitting data written on the disc to the codec at a reproduction bit rate; a signal processor for converting the data stored in the buffer into a signal suitable for recording and transmitting the converted signal together with real time recording/reproduction information onto the disc upon recording, and reproducing data read from the disc according to the real time recording/reproduction information recorded on a predetermined area of the disc; and a controller for controlling the driving of a servo mechanism including a spindle motor according to bit rate information of the real time recording/reproduction information.

To still yet further achieve the above and other objects of the present invention, there is provided a method of operating a file for a system capable of writing and rewriting real time files to which real time recording/reproduction attribute information is assigned, wherein the real time files are operated in correspondence with any one process among a real time file creation process, area allocation process, a recording process, a reproduction process, a deletion process, and a closing process using the real time recording/reproduction attribute information.

## BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings, in which:



FIG. 1 is a view illustrating a one-dimensional structure of a recording medium, the structure showing the relationship between file control information and file data;

FIG. 2 is a view illustrating an example in which two conventional files occupy blocks on a disc;

5 FIGS. 3A through 3D show examples of storage of real time recording/reproduction attribute information according to the present invention;

FIG. 4 is a view illustrating an example in which real time files according to the present invention, comprised of minimum contiguous storage blocks, occupy blocks on a disc;

10 FIG. 5 is a view illustrating a one-dimensional structure of a recording medium for recording real time AV data allocated into minimum contiguous storage blocks according to the present invention;

FIGS. 6A and 6B are views illustrating examples of copying a file comprised of minimum contiguous storage blocks according to the present invention;

15 FIG. 7 is a flowchart illustrating a reproducing method using real time recording/reproduction information according to an embodiment of the present invention;

FIG. 8 is a schematic block diagram of a disc recording and reproducing apparatus applied to the present invention;

20 FIG. 9 is a view showing a flow of control for real time recording/reproduction for a real time rewritable system;

FIG. 10 is a block diagram showing a flow of data for real time recording/reproduction for a real time rewritable system;

FIG. 11 is a view illustrating an example of allocating an unrecorded/unallocated area in a real time recorded/reproduced file;

25 FIGS. 12A through 12D are views illustrating examples of recording data of a real time recorded/reproduced file;

FIGS. 13A through 13D are views illustrating file control information corresponding to when different bit rates are provided in different sections and when an identical bit rate is provided in the entire file data section; and

FIGS. 14A through 14C are views illustrating partial deletion of real time recorded/reproduced file data.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of a recording medium for storing real time recording/reproduction information, a real time recording and reproducing method and apparatus, and a file operating method using the real time recording/reproduction information will now be described referring to the attached drawings.

FIGS. 3A through 3D show examples of storing real time recording/reproduction information (this can be called real time recording/reproduction attribute information) according to the present invention. As shown in FIG. 3A, the real time recording/reproduction information can be provided as an attribute to each real time file. As an example, the real time recording/reproduction attribute information can be stored in an extended attribute field in a file entry or a stream directory ICB (information control block) field when a file system is a universal disk format (UDF) system.

Alternatively, the real time recording/reproduction attribute information can be stored in a file identifier descriptor field, a file type field, or a flag field among an ICB TAG field in a file entry. The file entry can be called a file control information area or a file structure area.

As shown in FIG. 3B, real time recording/reproduction attribute information for each file can be stored in a predetermined area (information area) in each file. For example, in the case of a real time rewritable (RTRW) format, real time recording/reproduction attribute information can be stored in a data file named RTRW\_TS.VOB.

As shown in FIG. 3C, real time recording/reproducing attribute information for each file can be stored in a separate file. As an example, real time recording/reproduction attribute information can be stored in an information file having an RTRW format named RTRW\_TS.IFO. As another example, when the file system is the UDF system, the real time recording/reproduction attribute information can be stored in a volume structure area separate from a file structure area, as shown in FIG. 3D.

Therefore, when real time recording/reproduction attribute information is stored in the volume structure area or file structure area in the UDF system, the real time recording/reproduction attribute information is first interpreted upon mounting a volume or opening a file, and data is then recorded/reproduced in real time according to the interpreted information.

Real time recording/reproduction file indication information (e.g., identifier = "AV file") representing that a file requires real time recording/reproduction is included in the real time recording/reproduction attribute information. Among information on the size of the minimum contiguous storage block satisfying the condition of expression 1, reproduction time information for ensuring minimum contiguous storage, recording/reproduction bit rate information, and information on the contiguous recording/reproduction type, at least one can be stored in the real time recording/reproduction attribute information. Here, if there are three types of discs A, B and C, the contiguous recording/reproduction type information can be predetermined as follows:

type A = 10.08 Mbps, type B = 1.4 Mbps, type C = 8 Mbps.

An attribute representing whether files are currently arranged so as to be recorded/reproduced in real time, i.e., an attribute representing the current real time recordable/reproducible state of files, is also included in the real time recording/reproduction attribute information.

Real time recording/reproduction bit rate information is stored in the real time recording/reproduction attribute information. When the recording/reproduction bit rate is changed in each section, information associated with a plurality of bit rate values and sections (e.g., position information) can be stored in the real time recording/reproduction attribute information. The maximum allowable value of the real time recording/reproduction bit rate can be further stored in the real time recording/reproduction attribute information. Here, the control information of a spindle motor can be obtained by using the recording/reproduction bit rate information.

In addition, file defect management information, file buffering information, file allocation information, etc., can be included in the real time recording/reproduction attribute information. That is, if file defect management information is stored in the real time

recording/reproduction attribute information, replacement of a defective block with a spare area is not attempted when reading or writing fails, and further reading or writing of the defective block is not attempted.

For example, file allocation information such as non-allocation of a defective block replaced by a spare area as a data block can be stored in the real time recording/reproduction attribute information. File buffering information associated with the amount of data to be initially read from a track buffer and the amount of data to be recorded in the track buffer at a time can also be stored as the real time recording/reproduction attribute information.

Instead of individually storing many real time recording/reproduction attributes such as file defect management information, file allocation information, and file buffering information, the conditions for controlling real time files are classified into types, and the information of the classified types is recorded in a real time recording/reproduction file attribute information area. In this way, easy real time recording and reproduction can be achieved. For example, the following types of information can be provided:

type A: a data bit rate of 10Mbps, impossibility of allocation of a data block to a defective block replaced by a spare area, and impossibility of reattempt of reading upon failure in reading; and

type B: a data bit rate of 8Mbps, possibility of allocating a data block to a defective block replaced by a spare area, and impossibility of reattempting reading upon failure in reading.

Meanwhile, referring to FIG. 4 showing an example of real time files comprised of minimum contiguous storage blocks occupying blocks on a disc according to the present invention, a file A is a file requiring real time reproduction. If a minimum contiguous storage block satisfying the condition of expression 1 is comprised of four blocks, the file A is recorded in real time in units of four blocks. That is, the real time file A occupies blocks 0, 1, 2, 3, 5, 6, 7, 8, 11, 12, 13 and 14 on a disc. A general file B occupies blocks 4, 9, 10 and 15 on the disc. The general file B not requiring real time reproduction has a minimum contiguous storage block comprised of one block, and one or an arbitrary number of segments can be stored. This block generally corresponds to a sector of a disc.

The file A operates for real time reproduction, as follows.

In step 1, blocks 0, 1, 2 and 3 are read. In step 2, block 5 is searched for during playback of the blocks 0, 1, 2 and 3. In step 3, blocks 5, 6, 7 and 8 are read. In step 4, block 11 is searched for during playback of the blocks 5, 6, 7 and 8. In step 5, blocks 11, 12, 13 and 14 are read and played back.

5 If no areas for contiguous blocks capable of satisfying the minimum contiguous storage block exist on a disc upon storage of a file requiring real time reproduction, recording of the file is not possible. However, if a warning message like "Contiguous recording is not possible. Shall the minimum contiguous storage block be designated as one block and the file be stored in the designated block length ?" is sent to a user, and if the user  
10 requires storage, the file can be stored in the minimum contiguous storage blocks comprised of one block. In this case, the value of the initially-designated minimum contiguous storage block is stored in the information associated with the minimum contiguous storage block length included in the real time recording/reproduction attributes, but information indicating that the arrangement of currently stored files makes real time recording/reproduction  
15 impossible is stored in a current real time recordable/reproducible state attribute. This is done so that a file to be copied can be contiguously treated as a real time recording/reproduction file when the file is copied on different discs or the same disc.

In the present invention, a driving apparatus, such as a CD drive and a DVD drive, having a seek time (e.g., 150ms) significantly longer than a read time (e.g., 1.43ms), which  
20 is expressed by seek time >> read time, can also realize real time reproduction if it satisfies the condition of expression 1: seek time + read time < playback time.

Meanwhile, the minimum contiguous storage block limits the allocation of a free block on a disc to satisfy a predetermined purpose. Here, the free block means a non-used area having no defective blocks or a rewritable area among user areas that can be used by a  
25 user.

If the minimum contiguous storage block is defined as 16 blocks arranged in an error correction code (ECC) block, the allocation of a data block is not possible for less than 16 contiguous free blocks. Also, the allocation of a data block is not possible for 16 contiguous free blocks ranging over two ECC blocks. Here, the minimum contiguous storage block has  
30 the purpose of recording and reproducing a DVD-RAM in an ECC unit.

When all real time data is stored on physically-contiguous blocks on a disc, no seeking occurs, and thus recording/reproduction is prevented from being interrupted. However, since contiguous blocks do not infinitely exist, a minimum contiguous storage block is calculated and stored as real time recording/reproduction attributes of a file, and real time data is recorded in the minimum contiguous storage block. In this way, the interruption of a screen can be prevented.

If an MPEG playback bit rate ( $=V_b$ ) of 8Mbps, a seek time of 150ms, a read bit rate ( $=V_a$ ) of 11Mbps, a block of 2048 bytes, and data having ECC blocks each comprised of 16 blocks is recorded in a recording medium such as a disc, the minimum contiguous storage block  $S$  can be obtained according to the condition of expression 1 as shown in the following expression 2:

$$(1 - V_b/V_a) \times (2048 \times 8) \times S > V_b \times \text{seek time} / 1000 \quad \dots(2)$$

From this expression, the minimum contiguous storage block  $S$  is 261 blocks. When data is recorded in units of at least 261 blocks designated as the minimum contiguous storage block, real time reproduction is possible. However, 272 blocks corresponding to 17 contiguous ECC blocks can be designated as the minimum contiguous storage block. Here, the predetermined purpose is to ensure recording/reproduction when the maximum seek time is 150ms.

With one ECC block comprised of 16 blocks designated as the minimum contiguous storage block, and a limitation such as the seek time added as shown in expression 2, a free block allocation method for real time recording and reproduction is classified into steps, and the steps can be arranged as shown in Table 1:

[Table 1]

	number of contiguous blocks	purposes
third step	1088 blocks (ECC arrangement)	ensuring real time recording/reproduction between blocks requiring a seek time of 600ms
second step	272 blocks (ECC arrangement)	ensuring real time recording/reproduction between blocks requiring a seek time of 150ms
first step	16 blocks (ECC arrangement)	ensuring recording and reproduction in an ECC unit ( all allocated blocks must satisfy the first step)

A/V data is recorded and reproduced by arranging blocks satisfying a limitation on the minimum contiguous storage block whose number of blocks depends on each step, so that the blocks can be physically connected to each other, whereby real time recording and reproduction can be ensured. For example, when there are three groups of blocks of the minimum contiguous storage block: 16 blocks, 272 blocks and 1088 blocks, and the seek time is 150ms, the possibility of real time recording/reproduction depends on the method of connecting the blocks.

That is, when 272 blocks, 1088 blocks, and 16 blocks are sequentially arranged, real time recording and reproduction is possible, and when 16 blocks, 272 blocks and 1088 blocks are sequentially arranged, real time recording and reproduction is not possible.

Accordingly, the minimum contiguous storage block can be effectively recorded and reproduced in real time using the allocation of blocks by steps and the block connecting method.

Meanwhile, if the end portion of a file is not filled with as much data as in a minimum contiguous storage block as shown in FIG. 5, even when the file is recorded according to the condition of the minimum contiguous storage block, an attribute representing that data blocks for the unfilled area are allocated but not recorded is stored as real time recording/reproduction information, thus allowing real time playback upon additional recording.

That is, referring to FIG. 5 showing the one-dimensional structure of a recording medium in which real time AV data stored in the minimum contiguous storage block is placed, real time recording/reproduction attribute information in addition to the length of a file, information on the position of file data, information on the possibility or impossibility of reading/writing a file, etc., is further stored in file control information positioned at a disk block #1. Two minimum contiguous storage blocks each comprised of 272 data blocks are allocated to first file data placed at a disk block #m, 272 data blocks for the minimum contiguous storage block are allocated to second file data positioned at a disk block #n, and 200 data blocks and 72 allocated/unrecorded blocks are allocated to third file data positioned at a disk block #o.

When a file for real time recording/reproduction is copied on the same disc or different discs, the data blocks of the file must be arranged on the disc using real time recording/reproduction attribute information so that the file can be played back in real time. If the arrangement of the data blocks is not possible, the data blocks are arranged on the same basis as the arrangement basis of general file blocks. Here, the real time recording/reproduction attribute information maintains the original attribute information, but the impossibility of real time recording/reproduction is set as a current real time recordable/reproducible state attribute.

Also, when an operating system (OS) detects defective blocks on a disc upon copying of a file, data blocks to be copied must be arranged in consideration of the original real time recording/reproduction attribute information and medium defect management information recorded in a secondary defect list (SDL). For example, when the minimum contiguous storage block is 40 blocks as shown in FIG. 6A, data blocks are arranged in consideration of a defective area of a disc to copy a file on, as shown in FIG. 6B. On the other hand, when



the OS does not detect defects recorded in the SDL, data is allocated to blocks other than the defective block area in an application program for copying and in consideration of real time recording/reproduction attribute information as shown in FIG. 6B.

FIG. 7 is a flowchart illustrating a reproducing method using real time recording/reproduction information, according to an embodiment of the present invention. A disc is loaded on a player in step S101, and the player reads a volume area from the disc in step S102. A determination of whether real time recording/reproduction information exists in the volume area is made in step S103. If real time recording/reproduction information exists in the volume area, playback of files is set in consideration of the real time recording/reproduction information, in step S104. If it is determined in step S103 or after step S104 that no real time recording/reproduction information exists on the volume area, reading of the volume area is completed in step S105.

Thereafter, a file is read in step S106. It is determined whether real time recording/reproduction information exists in the read file, in step S107. If the real time recording/reproduction information exists in the read file, playback of the file is set in consideration of the real time recording/reproduction information, in step S108. If it is determined in step S107 or after step S108 that no real time recording/reproduction information exists in the read file, the read file is played back in consideration of whether the real time recording/reproduction information has been set, in step S109.

Here, when real time recording/reproduction information exists in the volume structure area, steps S107 and S108 may not be performed. Also, when real time recording/reproduction information exists in a file control information area, steps S103, S104 and S105 may not be performed.

FIG. 8 is a schematic block diagram of a disc recording and reproducing apparatus to be applied to the present invention. The function of the apparatus for recording and reproducing A/V data using a recordable and rewritable disc is divided into recording and reproduction.

Upon recording, a codec 110 compresses and encodes an audio/video (A/V) signal from an external bitstream using a predetermined compression scheme, and writes data compressed according to a recording/reproduction bit rate ( $V_b$ ) to a track buffer 120. An

error correction encoder and decoder (ECC) 130 error-correct encodes the data written to the track buffer 120, reads the error-correction encoded data at a write/read bit rate  $V_a$ , and applies the result to a pickup unit 140. Also, the ECC 130 applies real time recording/reproduction information generated under the control of a controller 170 to the pickup unit 140 so that the information can be recorded on a volume structure area or a file control information area. The pickup unit 140 converts the error-correction encoded data into a radio frequency (RF) signal and records the RF signal on a disc 150. Here, the recording rotating speed of a spindle motor 160 for driving the disc 150 is controlled according to a servo control signal from the controller 170.

Upon reproduction, when real time recording/reproduction information is stored in the file control information area or the volume structure area, buffering information associated with the amount of data to be initially read from the track buffer, file allocation information, defect management information, recording/reproduction bit rate information, etc., are read in advance, and reading of file data is controlled on the basis of the read information. File data to be satisfied by the condition of the minimum contiguous storage block is read from the disc 150 at a write/read bit rate  $V_a$ . The read file data is error-correction decoded by the ECC 130 via the pickup unit 140, and written to the track buffer 120. The codec 110 reads data written to the track buffer 120 at the recording/reproduction bit rate  $V_b$ , decodes the read data, and reproduces A/V data.

When recording/reproducing bit rate information exists in the real time recording/reproduction information, the controller 170 obtains the control information of the spindle motor 160 from the recording/reproducing bit rate information provided from the pickup unit 140 and the ECC 130, and can drive not only the spindle motor but also a servo mechanism.

FIG. 9 is a view showing the flow of control for recording/reproducing data on a disc to which real time real time recording/reproduction attributes are provided, in a real time rewritable (RTRW) system.

The RTRW system is comprised of an application layer 201 for producing a command associated with A/V data recording/reproduction, a Windows kernel 202 for interpreting the produced command, and a device driver 203 having a file system the same as the file system

of a DVD-RAM device driver for requesting a corresponding function according to the command interpreted by the Windows kernel 202 by transmitting a driver command to a drive 204. Here, the Windows kernel 202 and the device driver 203 correspond to a file system layer, and the Windows kernel 202 can be called a kernel layer.

FIG. 10 is a block diagram showing the flow of real time recording/reproduction data for a computer system among RTRW systems. Upon recording, the following processes are performed in a multitasking manner: storing A/V data input to an A/V encoder 211 in a computer main memory 212 in real time; storing A/V data stored in the computer main memory 212 in a first-in first-out (FIFO) file of a hard disk drive (HDD) 213; and storing the A/V data from the FIFO file of the HDD 213 in a DVD-RAM disk 214. Here, when a sufficient main memory exists on a computer, the FIFO file may not exist in the HDD.

Upon reproduction, a process for storing A/V data from the DVD-RAM disk 214 in a computer main memory 215 in real time and a process for reading the A/V data stored in the main memory 215 through an A/V decoder 216 are performed in a multitasking way.

For example, the function of an RTRW system using a Windows kernel is divided into creation of a file to which real time recording/reproduction attributes are provided, allocation of a data area, data recording, data reproduction, data deletion, and file closing, and these divided functions will now be described referring to FIG. 9.

Method of creating a real time recording/reproduction file.

In the first step, a Windows kernel API (application programming interface) called to create a real time recording/reproduction file is a create file. The application layer 201 assigns a file attribute as FILE\_ATTRIBUTE\_RTRW to the create file to create the real time recording/reproduction file, and calls the Windows kernel 202 as in the following example:

example: `FileHandle = CreateFile ("AVFILE.MPG",FILE_ATTRIBUTE_RTRW,...)`

In the second step, the Windows kernel 202 orders the DVD-RAM device driver 203 to create a file.

In the third step, the DVD-RAM device driver 203 designates a FILE\_ATTRIBUTE\_RTRW attribute when the file generation function is ordered. When the FILE\_ATTRIBUTE\_RTRW attribute is designated, file control information is stored in an

extended attribute area of a file entry, a stream directory ICB (information control block) area, a file identifier descriptor area, or a file type area or flag area of an ICB TAG field in a file entry. Here, bit rate information can also be set when an A/V file is created.

Method of allocating an allocated/unrecorded area of a real time  
5 recording/reproduction file.

In the first step, a Windows kernel API called to allocate an allocated/unrecorded area of a real time recording/reproduction file is a set file pointer having a seek function. In order for the application layer 201 to pre-allocate a data area of a real time recording/reproduction file in advance as an allocated/unrecorded area as large as a minimum  
10 contiguous storage block, the set file pointer calls the Windows kernel 202 as in the following example:

example: SetFilePointer (FileHandle,8x1024x1024,NULL,FILE\_END)  
SetFileBitrate (FileHandle,bitrate)

Alternatively, a data area necessary for real time recording/reproduction can be pre-allocated in advance as an allocated/unrecorded state using the SetFileBitrate  
15 (FileHandle,bitrate). Here, when the application layer knows a bit rate, and an API for converting the bit rate into the number of blocks exists in the file system layer, the number of blocks obtained by the API can be secured as the data area necessary for real time recording/reproduction in an allocated/unrecorded state using the SetFilePointer.

20 In the second step, the Windows kernel 202 orders the DVD-RAM device driver 203 to seek a file.

In the third step, the DVD-RAM device driver 203 checks if real time recording/reproduction attributes are assigned to a file, upon ordering of the file seeking function, and secures an allocated/unrecorded data area as large as the length for seeking  
25 according to minimum contiguous storage conditions (for example, file defect management, file allocation, file buffering, the magnitude of a minimum contiguous storage block, and bit rate information) specified in the assigned real time recording/reproduction attributes, as shown in FIG. 11. One pre-allocated area or a plurality of areas are arranged in an ECC unit and can be allocated.

30 Method of recording data of a real time recording/reproduction file.

In the first step, a Windows kernel API 202 called to record the data of the real time recording/reproduction file is a write file. The application layer 201 calls a Windows kernel using a write file as in the following example, to store real time data:

example: WriteFile (FileHandle,AV\_Buffer,32x1024,NULL,NULL)

In the second step, the Windows kernel 202 calls the file recording function of the DVD-RAM device driver 203.

In the third step, the DVD-RAM device driver 203 checks if real time recording/reproduction attributes are assigned to a file, upon calling the file recording function. If the real time recording/reproduction attributes are assigned, A/V data to be recorded is recorded in an allocated/unrecorded area according to real time recording conditions. Upon recording, when no allocated/unrecorded area exists, the magnitude of recorded data is reported to the application layer 201. The application layer 201 pre-allocates an allocated/unrecorded area designated as the real time recording/reproduction attributes to record the left-over unrecorded data using a seek command SetFilePointer with reference to the amount of recorded data, and again records the left-over data.

That is, as shown in FIG. 12A, A/V data of 32 x1024 bytes is recorded in an allocated/unrecorded area of 8x1024x1024 bytes shown in FIG. 11, and the residual area is still allocated as the allocated/unrecorded area.

As shown in FIG. 12B, when the amount of data recorded in a variable written in the application layer 201 is reported since the allocated/unrecorded area is 32x1024 bytes short, the file system layer automatically pre-allocates an unallocated area using bit rate information designated through the SetFileBtrate. As shown in FIG. 12C, the residual data is recorded in the ECC block unit. When a defective block is generated during recording and an error is thus generated, a block corresponding to the defective block is excluded from the allocated/unrecorded area as shown in FIG. 12D.

Here, when the bit rates for sections can be distinguished from each other, information associated with the bit rate for each section can be recorded in a file control information area. That is, FIGS. 13A and 13B show an example of a plurality of bit rate values (here,  $V_1$ ,  $V_2$  and  $V_3$ ) and information associated with sections stored as real time recording/reproduction information in a file control information area when different bit rates

are provided in different sections. FIGS. 13C and 13D show an example of one bit rate value (here,  $V_b$ ) stored as real time recording/reproduction information in a file control information area when an identical bit rate is provided in the entire file data section.

#### Method of reproducing real time recording/reproduction file data.

5 In the first step, a Windows kernel 202 called to reproduce the data of a real time recording/reproduction file is a read file. The application layer 201 calls a Windows kernel using the read file as in the following example, to reproduce real time data:

example: ReadFile (FileHandle, AV\_Buffer, 32x1024, NULL, NULL)

10 In the second step, the Windows kernel 202 orders the DVD-RAM device driver 203 to read a file.

15 In the third step, the DVD-RAM device driver 203 checks if real time recording/reproduction attributes are assigned to the file, when the file reading function is ordered. If the real time recording/reproduction attributes are assigned, A/V data as long as the length for reproduction is reproduced from an A/V data area according to real time reproduction conditions.

Here, when a defect is generated in a block to be reproduced, a read command indicating that allocated/unrecorded file attributes are assigned but not read is transmitted from the DVD-RAM device driver 203 to the drive 204.

20 a real time recording command and a reproducing command provided by a command interface of the DVD-RAM device driver must be used upon real time recording/reproduction.

#### Method of deleting part of real time recording/reproduction file data.

25 In the first step, a "DeletePartOfFile" is called as the Windows kernel 202 to delete part of the data of a real time recording/reproduction file. In order to delete part of real time data, the application layer 201 calls the Windows kernel 202 using the "DeletePartOfFile" as in the following example:

example: DeletePartOfFile (FileHandle, Offset, Size)

In the second step, the Windows kernel 202 orders the DVD-RAM device driver 203 to delete part of the file.

In the third step, when partial deletion of the file is ordered, the DVD-RAM device driver 203 checks if real time recording/reproduction attributes are assigned to the file, and deletes data from an A/V data area according to real time conditions if the real time recording/reproduction attributes have been assigned. Upon partial deletion of a file, a file for managing a dummy file or an ECC padding space list is created under a root directory on a system file.

FIG. 14A shows an area to be deleted from a real time file in which A/V data is arranged in ECC units. The deletion area is allocated to a free area as shown in FIG. 14B, and an A/V data section pertaining to the deletion area, among an ECC block ranging over the boundary of the deletion area, is called a padding space. A/V data in this padding space is managed as a separate file on the system file and stored in an allocation descriptor (AD) list in an ECC padding space list. A/V data not pertaining to the deletion area, in the ECC block, is stored in the AD list of a file entry. The ECC padding space list is again updated according to a function such as deletion or writing. When an application of the method according to the present invention is a UDF system, the ECC padding space list can be described by a short allocation descriptor.

In FIG. 14B, the A/V file space and the padding space of the ECC block ranging over the boundary of the deletion area have extent lengths. As shown in FIG. 14C, the A/V file space of the ECC block ranging over the boundary of the deletion area has both an extent length and an information length, but the padding space is managed as an allocation descriptor having an extent length and an information length of "0" in the AD list in an A/V file entry. The A/V file space not pertaining to the deletion area, in the ECC block, is also managed in the AD list in the AV file entry. In this case, the padding space can be defined as an extended allocation descriptor of UDF.

Method of closing a real time recording/reproduction file.

In the first step, a CloseHandle function is called as a Windows kernel 202 to close a real time file. In order to close a real time recording/reproduction file, the application layer 201 calls the window kernel 202 using the CloseHandle as in the following example:

example: CloseHandle (FileHandle)

In the second step, the window kernel 202 orders the DVD-RAM device driver 203 to seek a file.

In the third step, when the file closing function is ordered, the DVD-RAM device driver 203 updates file control information (file entry, etc.) and disk information (e.g., free area information, etc.).

According to the present invention as described above, real time recording/reproduction attributes are assigned to a file, and the file is recorded/reproduced in a different way from a general file. In this way, a real time recording/reproduction file can be recorded/reproduced in real time.

Also, in the present invention, files are divided into real time files and general files, and defect management information, file allocation information, buffering information, and the magnitude information of a minimum contiguous storage block provided in each step are assigned as real time recording/reproduction information to the real time file upon recording/reproduction. Thus, real time recording/reproduction can be effectively performed.

Furthermore, in the present invention, the control information of a spindle motor is obtained from real time recording/reproduction information associated with a recording/reproduction bit rate, thus controlling the spindle motor.

Although a few preferred embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.



## CLAIMS

What is claimed is:

1           1.     A recording medium, comprising:  
2           real time files requiring real time recording/reproduction; and  
3           a file control information area in which real time recording/reproduction information  
4           for ensuring real time recording/reproduction of the real time files is stored.

1           2.     The recording medium as claimed in claim 1, wherein the real time  
2           recording/reproduction information includes file indication information indicating that the real  
3           time files require real time recording/reproduction.

1           3.     The recording medium as claimed in claim 1, wherein the real time  
2           recording/reproduction information includes at least one of recording/reproduction bit rate  
3           information, information on minimum contiguous storage blocks satisfying a condition in  
4           which a playback time of a current data block is greater than a sum of a seek time and a read  
5           time of a data block to be played back next, and information on a playback time for ensuring  
6           minimum contiguous storage.

1           4.     The recording medium as claimed in claim 3, wherein the  
2           recording/reproduction bit rate information includes control information of a spindle motor.

1           5.     The recording medium as claimed in claim 3, wherein the real time files have  
2           sections with different bit rates, and the recording/reproduction bit rate information includes  
3           a plurality of bit rate values corresponding to the different bit rates of the sections, and  
4           information associated with the sections.

1           6.     The recording medium as claimed in claim 5, wherein the real time  
2           recording/reproduction information further includes a maximum allowable value information  
3           of a real time recording/reproduction bit rate of the real time files.

1           7.     The recording medium as claimed in claim 3, wherein the information on the  
2 minimum contiguous storage blocks is determined depending on a maximum seek time of the  
3 current data block.

1           8.     The recording medium as claimed in claim 3, wherein the minimum  
2 contiguous storage blocks are determined in accordance with a size of an error correction  
3 code block unit and a maximum seek time of the current data block.

1           9.     The recording medium as claimed in claim 8, wherein the real time  
2 recording/reproduction information further includes block connecting information for  
3 connecting blocks for the minimum contiguous storage blocks, to accomplish the real time  
4 reproduction.

1           10.    The recording medium as claimed in claim 3, wherein the real time  
2 recording/reproduction information further includes attribute information indicating that if an  
3 end portion of a file is not filled with data by the minimum contiguous storage blocks, data  
4 blocks for the unfilled portion are allocated in advance but unrecorded.

1           11.    The recording medium as claimed in claim 3, wherein the real time  
2 recording/reproduction information further includes current real time recordable/reproducible  
3 state information indicating whether a current file is arranged so as to be  
4 recorded/reproduced in real time.

1           12.    The recording medium as claimed in claim 3, further comprising a spare area,  
2 wherein the real time recording/reproduction information further includes file defect  
3 management information indicating that replacement of a defective block with a block in the  
4 spare area and rereading or rewriting of the defective block are not attempted when reading  
5 or writing of one of the real time files fails.

1           13.    The recording medium as claimed in claim 12, wherein the real time  
2 recording/reproduction information further includes file allocation information indicating that  
3 a data block is not allocated to the defective block replaced by the spare area.

1           14.    The recording medium as claimed in claim 3, wherein the real time  
2 recording/reproduction information includes file buffering information associated with an  
3 amount of data to be initially read from a buffer and an amount of written data to a buffer at  
4 a time.

1           15.    The recording medium as claimed in claim 3, wherein the real time  
2 recording/reproduction information further includes contiguous recording/reproduction type  
3 information classified by conditions for controlling the real time files, the conditions  
4 including file defect management information, file allocation information, file buffering  
5 information, and the information of the minimum contiguous storage blocks.

1           16.    A recording medium, comprising:  
2 real time files requiring real time recording/reproduction; and  
3 a file control information area of a universal disk format (UDF) system in which real  
4 time recording/reproduction information for ensuring real time recording/reproduction of the  
5 real time files is stored.

1           17.    The recording medium as claimed in claim 16, the file control information  
2 area includes an extended attribute field of a file entry for the UDF system in which the real  
3 time recording/reproduction information is stored.

1           18.    The recording medium as claimed in claim 17, wherein the real time  
2 recording/reproduction information includes file indication information indicating that the real  
3 time files require real time recording/reproduction.

1           19.    The recording medium as claimed in claim 17, wherein the real time  
2 recording/reproduction information includes at least one of recording/reproduction bit rate  
3 information, information on a size of minimum contiguous storage blocks satisfying a  
4 condition in which playback time of a current data block is greater than a sum of a seek time  
5 and a read time of the current data block to be played back next, and information on a  
6 playback time for ensuring minimum contiguous storage.

1           20.    The recording medium as claimed in claim 16, wherein the file control  
2 information area includes a file identifier descriptor field of the UDF system in which the  
3 real time recording/reproduction information is stored.

1           21.    The recording medium as claimed in claim 20, wherein the real time  
2 recording/reproduction information includes file indication information indicating that the real  
3 time files require real time recording/reproduction.

1           22.    The recording medium as claimed in claim 16, wherein the file control  
2 information area includes a stream directory ICB (information control block) field for the  
3 UDF system in which the real time recording/reproduction information is stored.

1           23.    The recording medium as claimed in claim 22, wherein the real time  
2 recording/reproduction information includes file indication information indicating that the real  
3 time files require real time recording/reproduction.

1           24.    The recording medium as claimed in claim 22, wherein the real time  
2 recording/reproduction information includes at least one of recording/reproduction bit rate  
3 information, information on minimum contiguous storage blocks satisfying a condition in  
4 which playback time of a current data block is greater than a sum of a seek time and a read  
5 time of a data block to be played back next, and information on a playback time for ensuring  
6 minimum contiguous storage.

1           25.    The recording medium as claimed in claim 16, wherein the file control  
2 information area includes a file type field in an ICB TAG field of a file entry for the UDF  
3 system in which the real time recording/reproduction information is stored.

1           26.    The recording medium as claimed in claim 16, wherein the file control  
2 information area includes a file flag field in an ICB TAG field of a file entry for the UDF  
3 system in which the real time recording/reproduction information is stored.

1           27.    A recording medium comprising real time files requiring real time  
2 recording/reproduction, wherein real time recording/reproduction information for ensuring  
3 real time recording/reproduction of the real time files is stored in corresponding ones of the  
4 real time files.

1           28.    The recording medium as claimed in claim 27, wherein the real time  
2 recording/reproduction information is stored in a file "RTRW\_TS.VOB" in each real time  
3 file, respectively, and having a real time rewritable (RTRW) format.

1           29.    The recording medium as claimed in claim 27, wherein the real time  
2 recording/reproduction information includes file indication information indicating that the  
3 corresponding real time files require real time recording/reproduction.

1           30.    The recording medium as claimed in claim 27, wherein the real time  
2 recording/reproduction information includes at least one of recording/reproduction bit rate  
3 information, information on minimum contiguous storage blocks satisfying a condition in  
4 which playback time of a current data block is greater than a sum of a seek time and a read  
5 time of a data block to be played back next, and information on a playback time for ensuring  
6 minimum contiguous storage.

1           31.    A recording medium comprising:  
2           real time files requiring real time recording/reproduction, and  
3           a separate file in which real time recording/reproduction information for ensuring real  
4           time recording/reproduction of the real time files is stored.

1           32.    The recording medium as claimed in claim 31, wherein the separate file in  
2           which the real time recording/reproduction information is stored is a file "RTRW\_TS.VOB"  
3           in each real time file, respectively, and having a real time rewritable RTRW format.

1           33.    The recording medium as claimed in claim 31, wherein the real time  
2           recording/reproduction information includes file indication information indicating that the real  
3           time files require real time recording/reproduction.

1           34.    The recording medium as claimed in claim 31, wherein the real time  
2           recording/reproduction information includes at least one of recording/reproduction bit rate  
3           information, information on minimum contiguous storage blocks satisfying a condition in  
4           which playback time of a current data block is greater than a sum of a seek time and a read  
5           time of a data block to be played back next, and information on a playback time for ensuring  
6           minimum contiguous storage.

1           35.    A recording medium, comprising:  
2           real time files requiring real time recording/reproduction; and  
3           a volume structure area of a predetermined file system in which real time  
4           recording/reproduction information for ensuring real time recording/reproduction of the real  
5           time files is stored.

1           36.    The recording medium as claimed in claim 35, wherein the real time  
2           recording/reproduction information includes file indication information indicating that the real  
3           time files require real time recording/reproduction.

1           37.    The recording medium as claimed in claim 35, wherein the real time  
2 recording/reproduction information includes at least one of recording/reproduction bit rate  
3 information, information on minimum contiguous storage blocks satisfying a condition in  
4 which playback time of a current data block is greater than a sum of a seek time and a read  
5 time of a data block to be played back next, and information on a playback time for ensuring  
6 minimum contiguous storage.

1           38.    A recording and reproducing method comprising the steps of:

2           (a) arranging and recording real time files requiring real time recording/reproduction  
3 according to real time recording/reproduction in a recording medium according to real time  
4 recording/reproduction information for ensuring real time reproduction, and recording the  
5 real time recording/reproduction information in the recording medium; and

6           (b) reading and reproducing the real time files using the real time  
7 recording/reproduction information.

1           39.    The recording and reproducing method as claimed in claim 38, wherein the  
2 step (a) comprises storing the real time recording/reproduction information in a file control  
3 information area of the recording medium.

1           40.    The recording and reproducing method as claimed in claim 38, wherein the  
2 step (a) comprises storing the real time recording/reproduction information in a file control  
3 information area of a UDF system of the recording medium.

1           41.    The recording and reproducing method as claimed in claim 38, wherein the  
2 step (a) comprises storing the real time recording/reproduction information in each  
3 corresponding real time file.

1           42.    The recording and reproducing method as claimed in claim 38, wherein the  
2 step (a) comprises the real time recording/reproduction information associated with the real  
3 time files in a separate file from the real time files.

1           43.    The recording and reproducing method as claimed in claim 38, wherein the  
2 step (a) comprises storing the real time recording/reproduction information in a volume  
3 structure area of the recording medium.

1           44.    The recording and reproducing method as claimed in claim 38, wherein the  
2 real time recording/reproduction information includes file indication information indicating  
3 that the real time files require real time recording/reproduction.

1           45.    The recording and reproducing method as claimed in claim 38, wherein the  
2 real time files have sections with different bit rates, and the real time recording/reproduction  
3 information includes recording/reproduction bit rate information which includes information  
4 associated with the sections and a plurality of bit rate values corresponding to the different  
5 bit rates of the sections.

1           46.    The recording and reproducing method as claimed in claim 45, the step (a)  
2 comprises automatically arranging file data areas of the real time files according to the  
3 recording/reproduction bit rate information.

1           47.    The recording and reproducing method as claimed in claim 46, wherein the  
2 real time recording/reproduction information includes a maximum allowable value of the real  
3 time recording/reproduction bit rates.

1           48.    The recording and reproducing method as claimed in claim 38, wherein the  
2 real time recording/reproduction information includes at least one of minimum contiguous  
3 storage blocks satisfying a condition in which a playback time of a current data block is  
4 greater than a sum of the seek time and a read time of a data block to be played back next,  
5 and a playback time for ensuring minimum contiguous storage.



1           49.    The recording and reproducing method as claimed in claim 48, wherein the  
2   step (a) comprises arranging the real time files in the minimum contiguous storage blocks.

1           50.    The recording and reproducing method as claimed in claim 48, wherein the  
2   step (a) comprises the step (a1) if an end portion of one of the real time files is not filled  
3   with data by the minimum contiguous storage blocks while the one real time file is recorded  
4   in the minimum contiguous storage blocks, recording as the real time recording/reproduction  
5   information an attribute indicating that a number of data blocks corresponding to a size of the  
6   unfilled portion are allocated but unrecorded.

1           51.    The recording and reproducing method as claimed in claim 48, wherein the  
2   minimum contiguous storage blocks are classified according to a size of an error correction  
3   code block and a maximum seek time.

1           52.    The recording and reproducing method as claimed in claim 51, wherein the  
2   step (a) comprises arranging the real time files in the classified minimum contiguous storage  
3   blocks.

1           53.    The recording and reproducing method as claimed in claim 48, wherein the  
2   real time recording/reproduction information further includes current real time  
3   recordable/reproducible state information indicating whether a current file is arranged so as  
4   to be recorded/reproduced in real time.

1           54.    The recording and reproducing method as claimed in claim 48, wherein the  
2   real time recording/reproduction information further includes contiguous  
3   recording/reproduction type information classified by conditions for controlling real time  
4   files, the conditions including recording/reproduction bit rate information, file defect  
5   management information, file allocation information, file buffering information, and the  
6   information of the minimum contiguous storage blocks.

1           55.    The recording and reproducing method as claimed in claim 48, wherein the  
2 real time recording/reproduction information further includes at least one of file defect  
3 management information indicating that replacement of a defective block with a block in a  
4 spare area of the recording medium and rereading or rewriting of the defective block are not  
5 attempted when reading or writing has failed, file allocation information indicating that a data  
6 block is not allocated to the defective block replaced by the spare area, and file buffering  
7 information associated with an amount of data to be initially read from a buffer and an  
8 amount of data written from the buffer at a time.

1           56.    The recording and reproducing method as claimed in claim 38, wherein the  
2 step (b) comprises the substeps of:

3           (b1) reading a volume area on the recording medium; and

4           (b2) reproducing a file as one of the real time files in consideration of the real time  
5 recording/reproduction information if the real time recording/reproduction information exists  
6 in the volume area.

1           57.    The recording and reproducing method as claimed in claim 56, wherein the  
2 step (b2) comprises analyzing recording/reproduction bit rate information, defect  
3 management information, file allocation information, and file buffering information according  
4 to the real time recording/reproduction information in the volume area, and reading and  
5 reproducing file data in minimum contiguous storage blocks of the file.

1           58.    The recording and reproducing method as claimed in claim 38, wherein the  
2 step (b) comprises the substeps of:

3           (b1) determining whether the real time recording/reproduction information exists in a  
4 file area; and

5           (b2) reproducing a file in consideration of the real time recording/reproduction  
6 information if the real time recording/reproduction information exists in the file area.

1           59. The recording and reproducing method as claimed in claim 58, wherein the  
2 step (b2) comprises analyzing recording/reproduction bit rate information, defect  
3 management information, file allocation information, and file buffering information according  
4 to the real time recording/reproduction information in the file area, and reading and  
5 reproducing file data in minimum contiguous storage blocks.

1           60. The recording and reproducing method as claimed in claim 38, wherein the  
2 method further comprises the step of:

3           (c) copying a file to a free area from which a defective block is excluded, based upon  
4 the real time recording/reproduction information and general defect management information  
5 recorded on the recording medium.

1           61. The recording and reproducing method as claimed in claim 60, wherein the  
2 step (c) comprises copying the real time recording/reproduction information and the file  
3 together.

1           62. The recording and reproducing method as claimed in claim 60, wherein the  
2 step (c) comprises copying only real time file data based on the real time  
3 recording/reproduction information.

1           63. A recording and reproducing apparatus for recording and/or reproducing real  
2 time files on a disc using real time recording/reproduction information for ensuring real time  
3 recording/reproduction, the apparatus comprising:

4           a codec to compress and encode an input bitstream according to a predetermined  
5 compression scheme and to provide compressed and encoded data upon recording on the  
6 disc, and decode the compressed and encoded data upon reproduction from the disc;

7           a buffer to temporarily store the compressed and encoded data at a recording bit rate  
8 using bit rate information included in the real time recording/reproduction information, and  
9 transmitting the compressed and decoded data written on the disc to the codec at a  
10 reproduction bit rate;

11 a signal processor to convert the compressed and encoded data stored in the buffer  
12 into a signal suitable for recording and transmitting the converted signal together with the  
13 real time recording/reproduction information onto the disc upon recording, and reproducing  
14 the compressed and encoded data read from the disc according to the real time  
15 recording/reproduction information recorded on a predetermined area of the disc; and  
16 a controller to control driving of a servo mechanism including a spindle motor  
17 according to the bit rate information of the real time recording/reproduction information.

1 64. The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 real time files include sections having different bit rates, and the recording/reproduction bit  
3 rate information includes information associated with the sections and a plurality of bit rate  
4 values corresponding to the different bit rates.

1 65. The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 real time recording/reproduction information further includes a maximum allowable value of  
3 a real time recording/reproduction bit rate in the real time recording/reproduction  
4 information.

1 66. The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 controller automatically arranges file data areas of the real time files according to the  
3 recording/reproduction bit rate information.

1 67. The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 controller stores the real time recording/reproduction information in a file control information  
3 area of the disc.

1 68. The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 controller stores the real time recording/reproduction information in a file control information  
3 area of a universal disc format (UDF) system of the disc.

1           69.    The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 controller stores the real time recording/reproduction information in each real time file.

1           70.    The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 controller stores the real time recording/reproduction information associated with the real  
3 time files in a separate file of the disc distinct from the real time files.

1           71.    The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 controller stores the real time recording/reproduction information in a volume structure area  
3 of the disc.

1           72.    The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 real time recording/reproduction information includes file indication information indicating  
3 that one of the real time files requires real time recording/reproduction.

1           73.    The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 real time recording/reproduction information further includes at least one of minimum  
3 contiguous storage blocks satisfying a condition in which a playback time of a current data  
4 block is greater than a sum of a seek time and a read time of a data block to be played back  
5 next, and a playback time for ensuring minimum contiguous storage.

1           74.    The recording and reproducing apparatus as claimed in claim 73, wherein the  
2 minimum contiguous storage blocks are classified in accordance with a size of an error  
3 correction code block and a maximum seek time.

1           75.    The recording and reproducing apparatus as claimed in claim 73, wherein the  
2 real time recording/reproduction information further includes current real time  
3 recordable/reproducible state information representing whether a current file is arranged so  
4 as to be recorded/reproduced in real time.

1           76.    The recording and reproducing apparatus as claimed in claim 73, wherein the  
2 real time recording/reproduction information further includes contiguous  
3 recording/reproduction type information classified by conditions for controlling the real time  
4 files, the conditions including recording/reproduction bit rate information, file defect  
5 management information, file allocation information, file buffering information, and the  
6 information of the minimum contiguous storage blocks.

1           77.    The recording and reproducing apparatus as claimed in claim 63, wherein the  
2 real time recording/reproduction information further includes at least one of file defect  
3 management information indicating that replacement of a defective block with a block in a  
4 spare area of the disc and rereading or rewriting of the defective block are not attempted  
5 when reading or writing has failed, file allocation information indicating that a data block is  
6 not allocated to the defective block replaced by the spare area, and file buffering information  
7 associated with an amount of data to be initially read from the buffer and an amount of the  
8 data written from the buffer at a time.

1           78.    A method of operating a file for a system for writing and rewriting real time  
2 files to which real time recording/reproduction attribute information is assigned, the method  
3 comprising the step of operating the real time files in correspondence with any one process  
4 among a real time file creation process, an area allocation process, a recording process, a  
5 reproduction process, a deletion process, and a closing process, using the real time  
6 recording/reproduction attribute information.

1           79.    The method as claimed in claim 78, wherein the real time  
2 recording/reproduction attribute information includes file indication information indicating  
3 that a file requires real time recording/reproduction.

1           80.    The method as claimed in claim 78, wherein the real time  
2 recording/reproduction attribute information includes at least one of recording/reproduction  
3 bit rate information, information on minimum contiguous storage blocks satisfying a  
4 condition in which a playback time of a current data block is greater than a sum of the seek  
5 time and a read time of a data block to be played back next, and information on a playback  
6 time for ensuring minimum contiguous storage.

1           81.    The method as claimed in claim 80, wherein the selected process is the  
2 creation process, and the method further comprises the steps of:  
3           having an application layer call a kernel layer using a file creation command;  
4           having the kernel layer call a file creation function from a device driver by the kernel  
5 layer; and  
6           having the device driver create one of the real time files by designating real time  
7 recording/reproduction attributes, in response to the file creation function being called.

1           82.    The method as claimed in claim 80, wherein the selected process is the area  
2 allocation process, and the method further comprises the steps of:  
3           having an application layer call a kernel layer using a seek command;  
4           having the kernel layer call a file seek function from a device driver; and  
5           having the device driver check if real time recording/reproduction attributes have been  
6 set, in response to the file creation function being called, and pre-allocating an  
7 allocated/unrecorded data area having a length for seeking according to a minimum  
8 contiguous storage condition specified in the real time recording/reproduction attribute  
9 information.

1           83.    The method as claimed in claim 80, wherein the selected process is the  
2 recording process, and the method further comprises the steps of:  
3           having an application layer call a kernel layer using a record command;  
4           having the kernel layer call a file recording function from a device driver; and

5           having the device driver check if real time recording/reproduction attributes have been  
6 set, in response to the file recording function being called, and recording data in an  
7 allocated/unrecorded area of the disc according to a real time recording condition.

1           84.    The method as claimed in claim 83, further comprising the steps of:  
2           reporting a magnitude of recorded data to the application layer in response to an  
3 allocated/unrecorded allocation area being deficient in the recording step;  
4           having the application layer pre-allocate the allocated/unrecorded area using the area  
5 allocation process with reference to the magnitude of the recorded data; and  
6           recording residual data in the pre-allocated area.

1           85.    The method as claimed in claim 84, wherein the step of pre-allocating the  
2 allocated/unrecorded area comprises the step of automatically pre-allocating the  
3 allocated/unrecorded area according to bit rate information set by a file system layer.

1           86.    The method as claimed in claim 84, wherein in response to a defective block  
2 being generated during the recording of the data in the allocated/unrecorded area in the  
3 recording step, excluding the defective block from the allocated/unrecorded area.

1           87.    The method as claimed in claim 80, wherein the selected process is the  
2 reproduction process, and the method further comprises the steps of:  
3           having an application layer call a kernel layer using a reproduction command;  
4           having the kernel layer call a file reproduction function from a device driver; and  
5           having the device driver check if real time recording/reproduction attributes have been  
6 set, in response to the file reproduction function being called, and reproducing data from the  
7 disc according to a real time reproduction condition.

1           88.    The method as claimed in claim 80, wherein the selected process is the  
2 deletion process, and the method further comprises the steps of:  
3           having an application layer call a kernel layer using a deletion command;



4           having the kernel layer call a file deletion function from a device driver; and  
5           having the device driver check if real time recording/reproduction attributes have been  
6 set, in response to the file deletion function being called, and deleting data from the disc  
7 according to a real time condition.

1           89.    The method as claimed in claim 88, further comprising the steps of allocating  
2 the deletion area to a free area, and managing data in a padding space of an A/V data section  
3 pertaining to the deletion area among an error correction code (ECC) block ranging over a  
4 boundary of the deletion area as a separate file on a system file of the disc.

1           90.    The method as claimed in claim 89, further comprising storing and managing  
2 the data from the padding space in an allocation descriptor list in an ECC padding entry,  
3 wherein the padding space pertaining to the deletion area in an ECC block ranging over the  
4 boundary of the deletion area and an A/V file space not pertaining to the deletion area have  
5 extent lengths.

1           91.    The method as claimed in claim 80, wherein the selected process is the closing  
2 process, and the method comprises the steps of:

3           having an application layer call a kernel layer using a close command;  
4           having the kernel layer call a file closing function from a device driver; and  
5           having the device driver update file control information and disc information in  
6 response to the file closing function being called.

1           92.    The recording medium as claimed in claim 3, wherein the real time  
2 recording/reproduction information further includes current real time recordable/reproducible  
3 state information indicating whether it is possible to record/reproduce a current file in real  
4 time.

1           93.    The recording and reproducing method as claimed in claim 48, wherein the  
2   real time recording/reproduction information further includes current real time  
3   recordable/reproducible state information indicating whether it is possible to record/reproduce  
4   a current file in real time.

1           94.    The recording and reproducing apparatus as claimed in claim 73, wherein the  
2   real time recording/reproduction information further includes current real time  
3   recordable/reproducible state information indicating whether it is possible to record/reproduce  
4   a current file in real time.

## ABSTRACT OF THE DISCLOSURE

A recording medium for storing real time recording/reproduction information, a real time recording and reproducing method and apparatus, and a file operating method using the information. Real time recording/reproduction information for ensuring real time  
5 recording/reproduction is stored in a file control information area, in each real time file, or in a separate file, and real time recording/reproduction attributes are assigned to the file. Thus, real time recorded files can be continuously reproduced without interruption. Also, there are methods of creating a file to which real time recording/reproduction attributes are assigned, extending a data area, and recording and reproducing the file to which real time  
10 recording/reproduction attributes are assigned.

FIG. 1 (PRIOR ART)

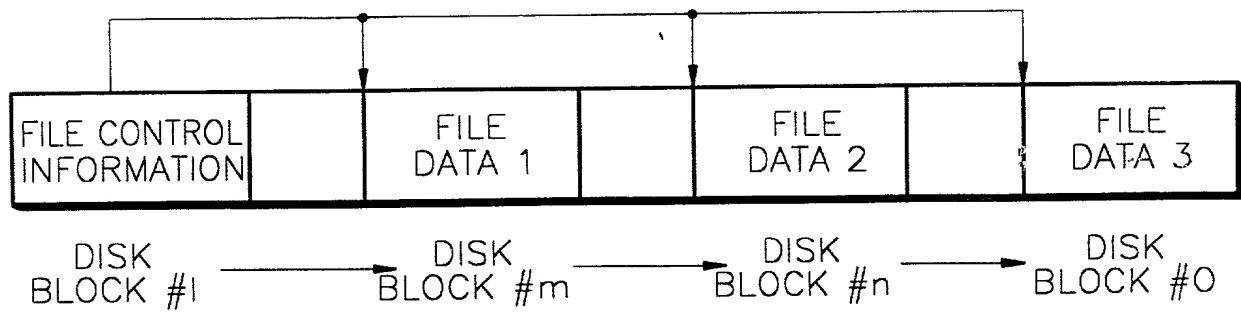
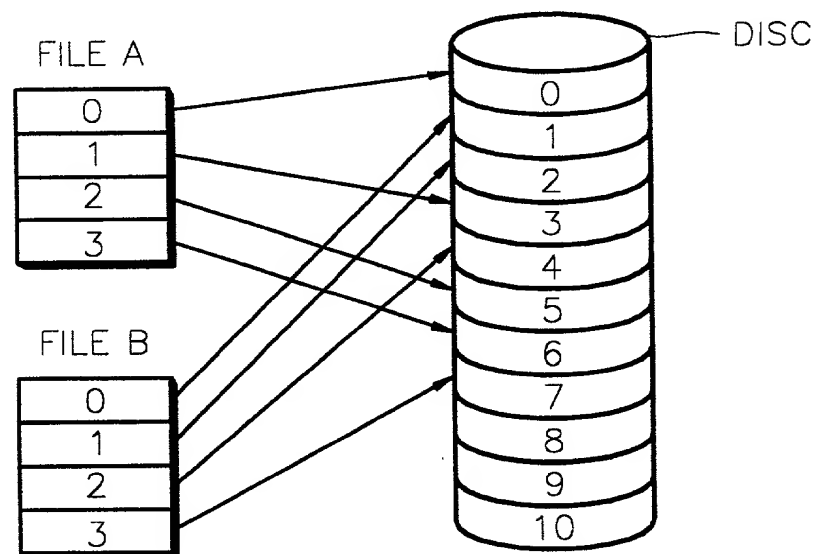


FIG. 2 (PRIOR ART)



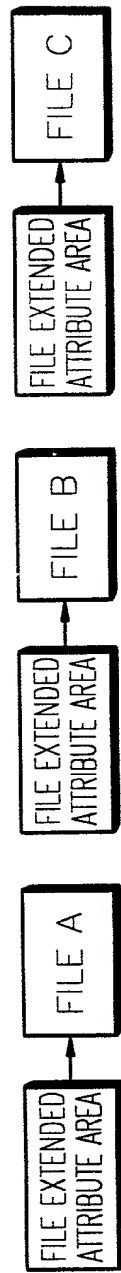


FIG. 3A

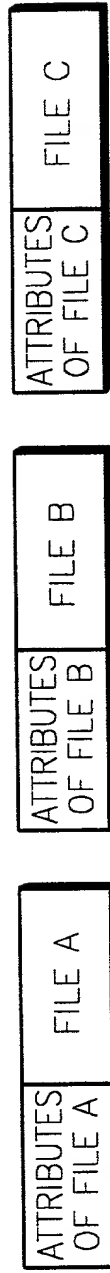


FIG. 3B



FIG. 3C

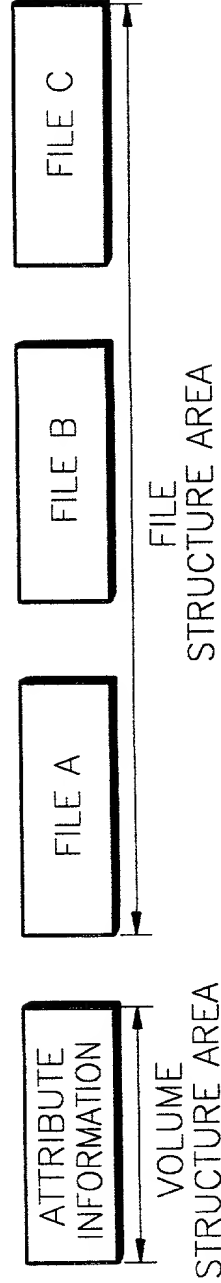


FIG. 3D

FIG. 4

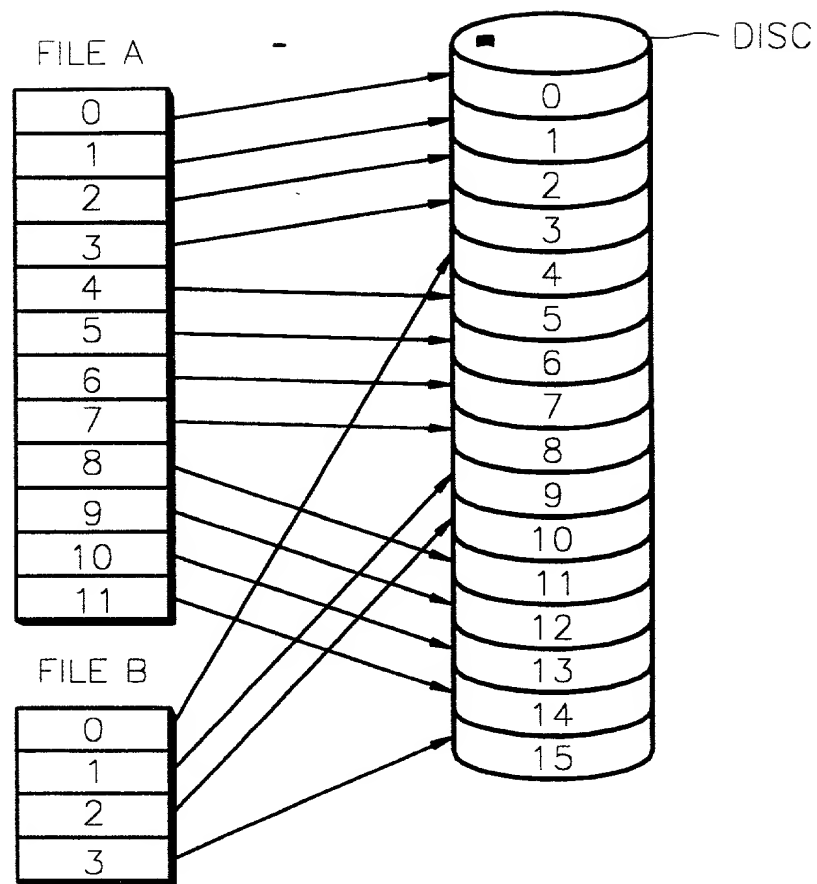


FIG. 6A

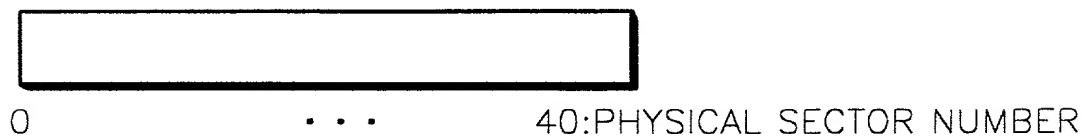


FIG. 6B

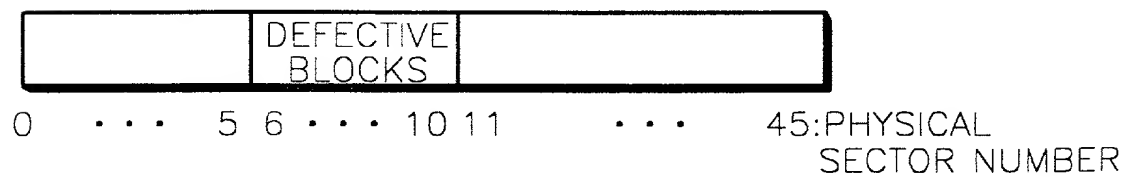


FIG. 5

REAL TIME RECORDING/REPRODUCTION  
ATTRIBUTE INFORMATION

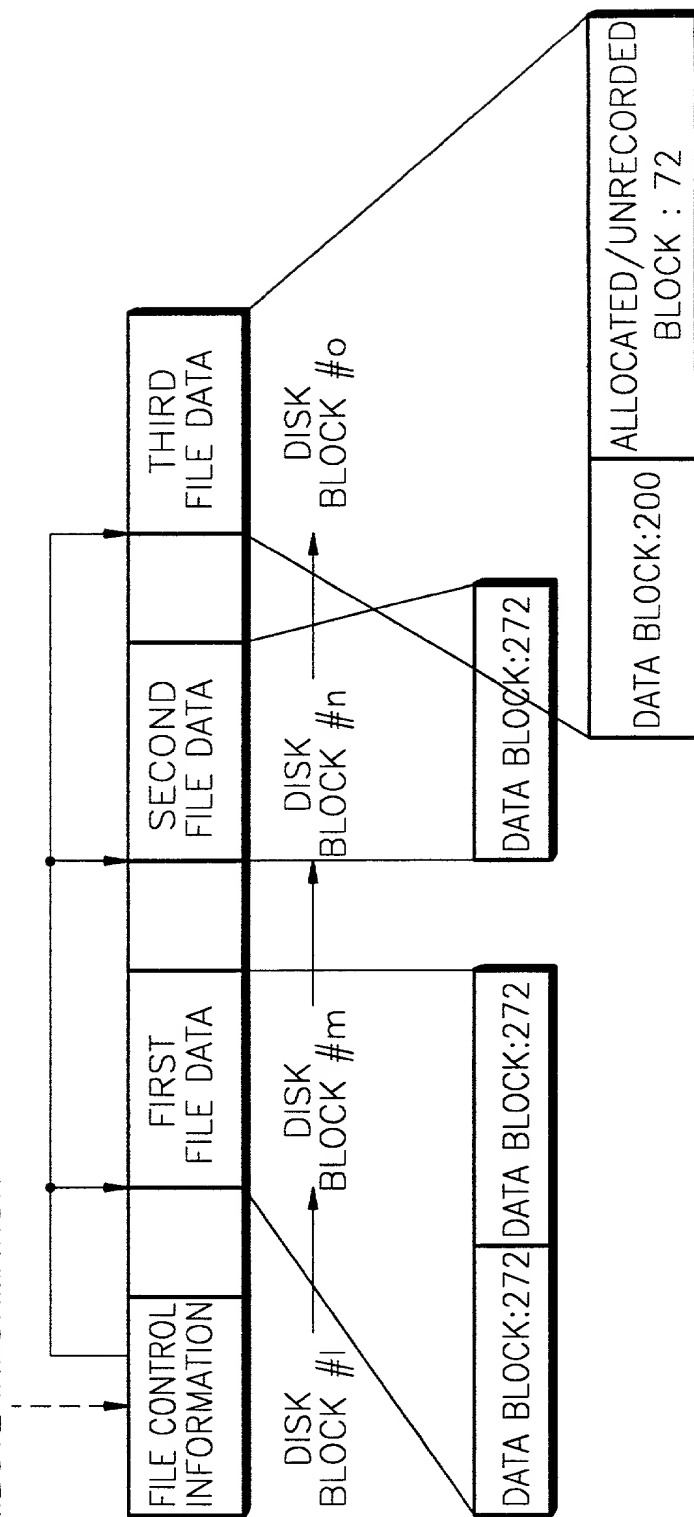


FIG. 7

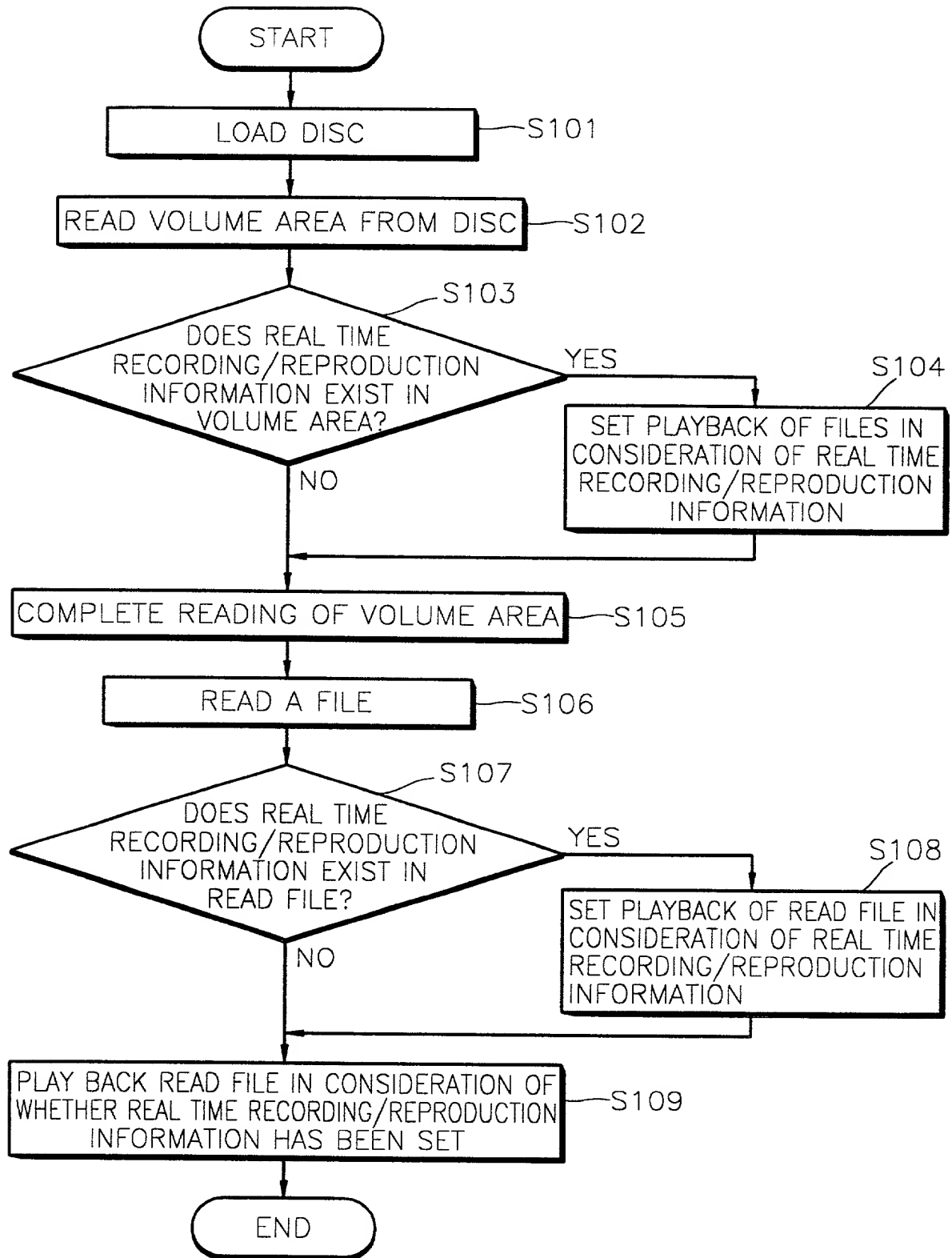




FIG. 8

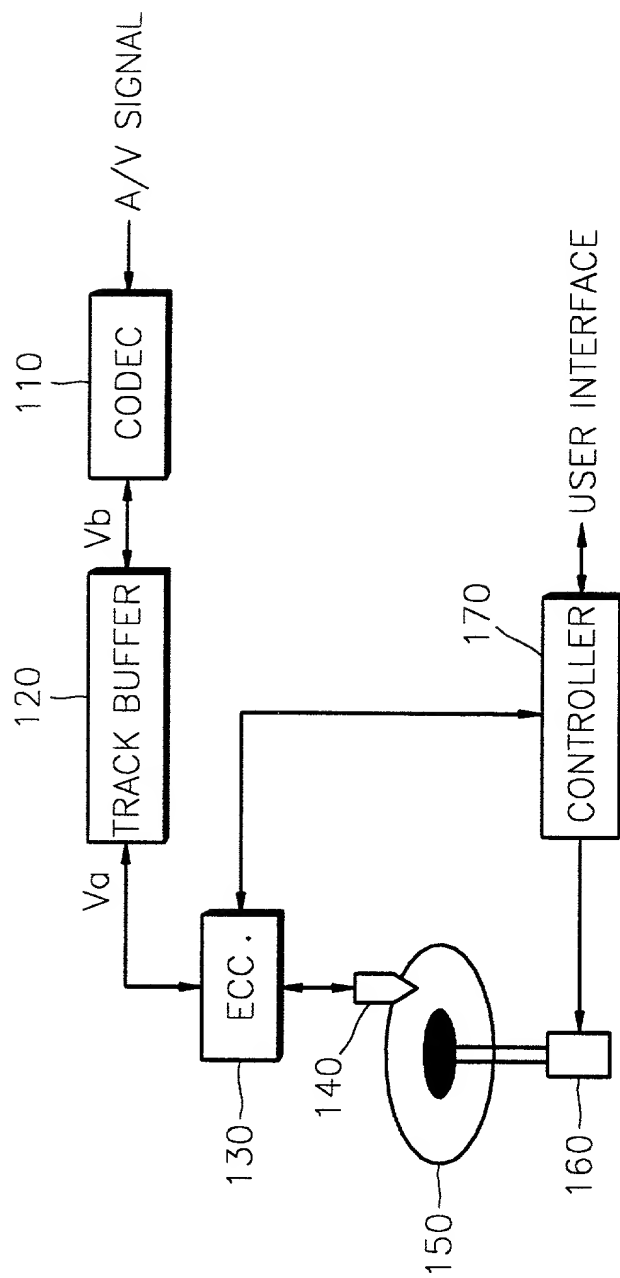


FIG. 9

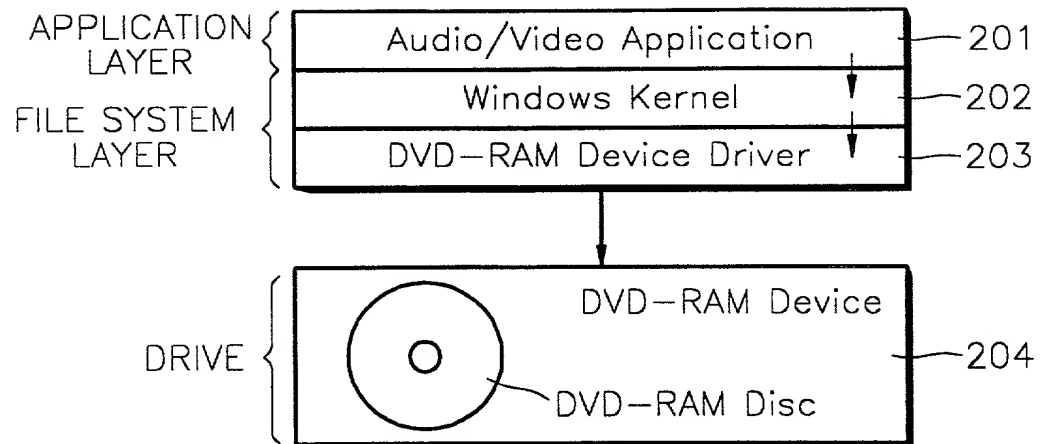


FIG. 10

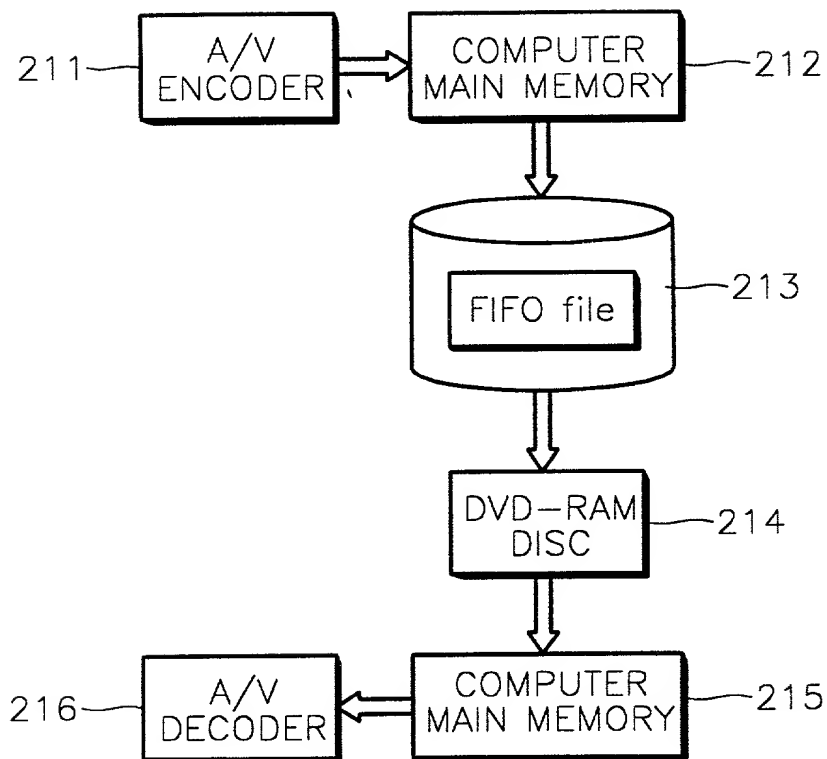
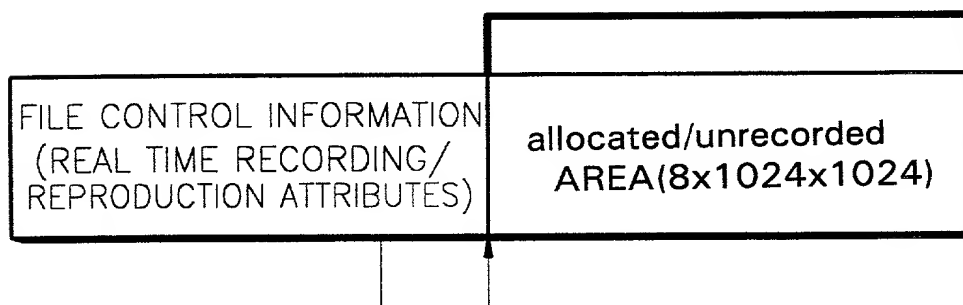


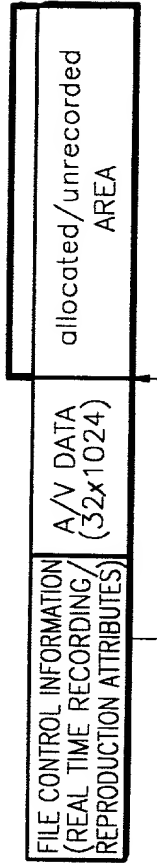
FIG. 11

SetFilePointer(FileHandle, 8x1024x1024, NULL, FILE\_END)  
 SetFileBitrate(FileHandle, bitrate)



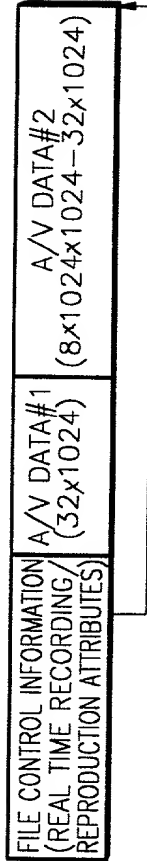
WriteFile(FileHandle, AV\_Buffer 32x1024, & Written, NULL)

FIG. 12A



WriteFile(FileHandle, AV\_Buffer 8x1024x1024, NULL, NULL)

FIG. 12B



WriteFile(FileHandle, AV\_Buffer 32x1024, & Written, NULL)

FIG. 12C

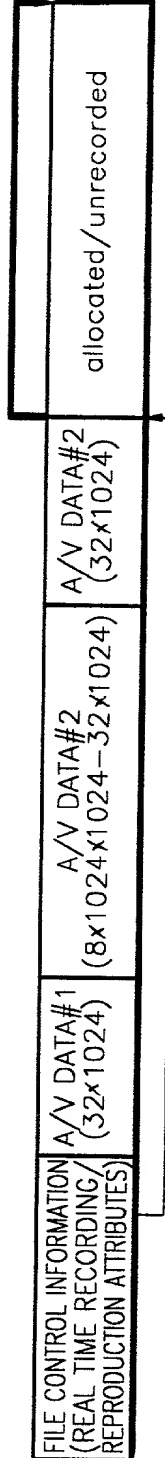
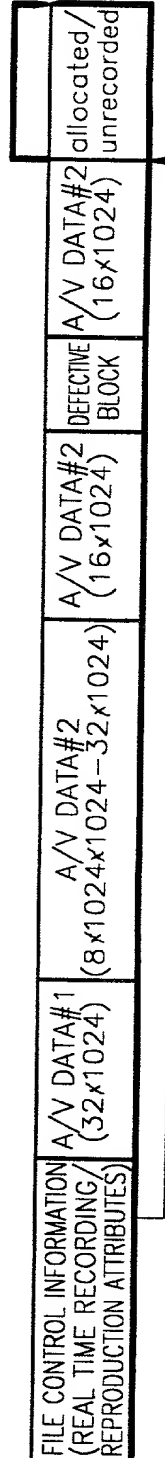
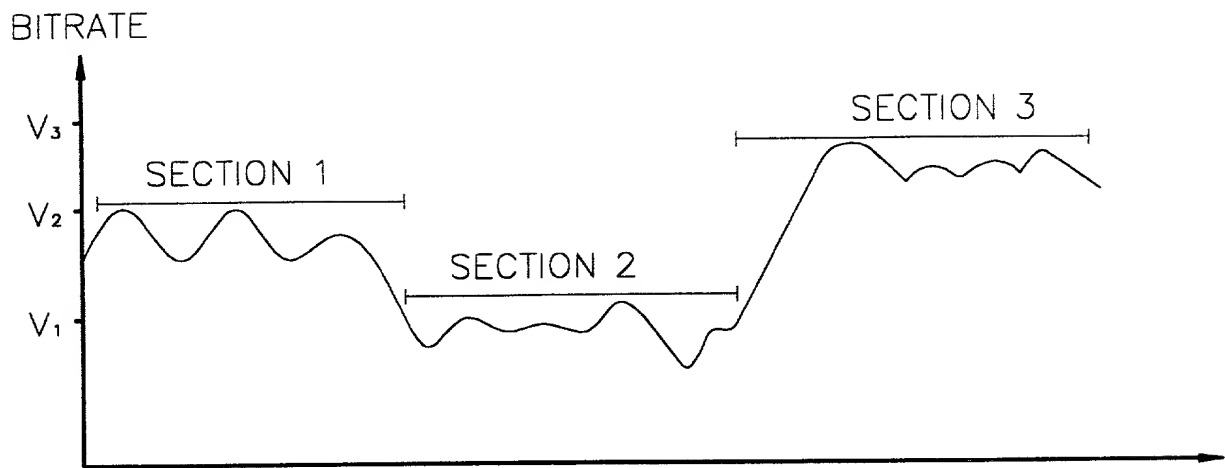


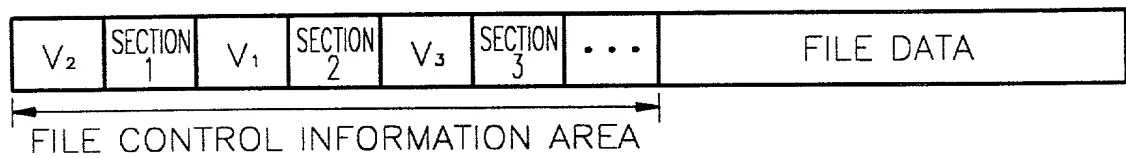
FIG. 12D



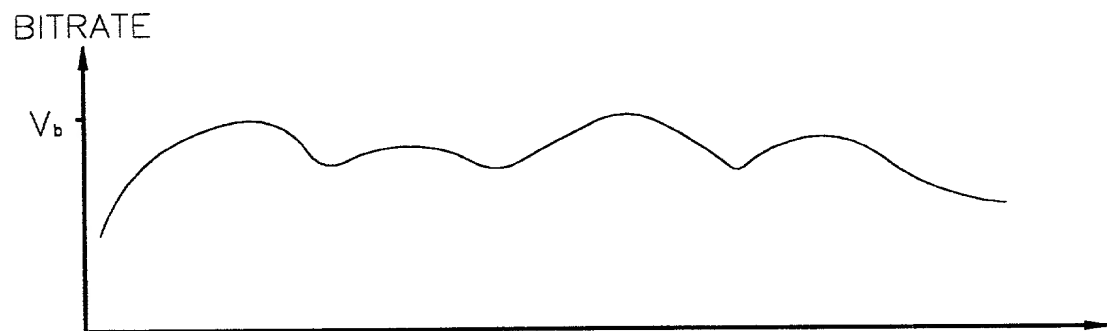
# FIG. 13A



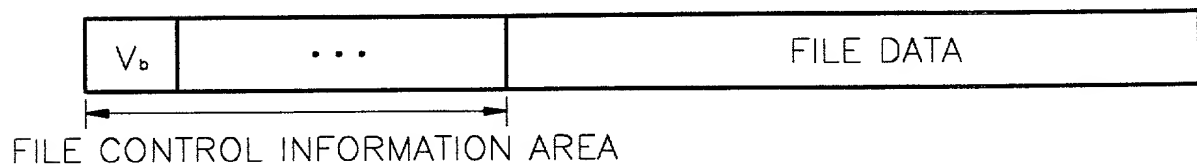
# FIG. 13B



# FIG. 13C



# FIG. 13D



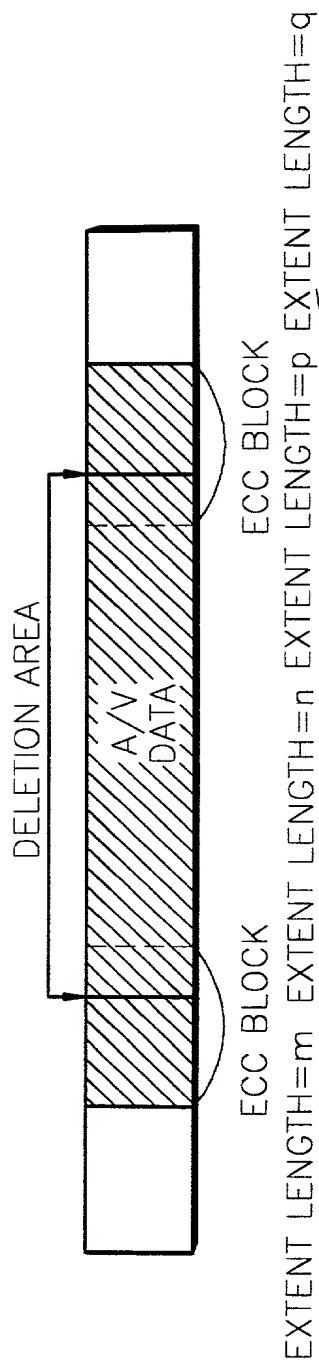


FIG. 14A

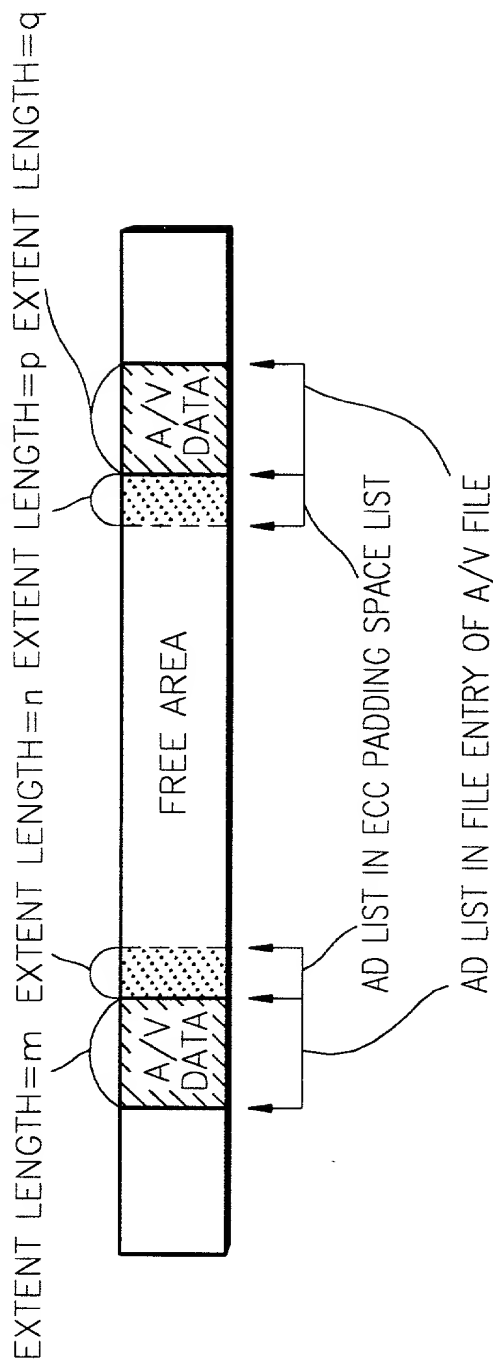


FIG. 14B

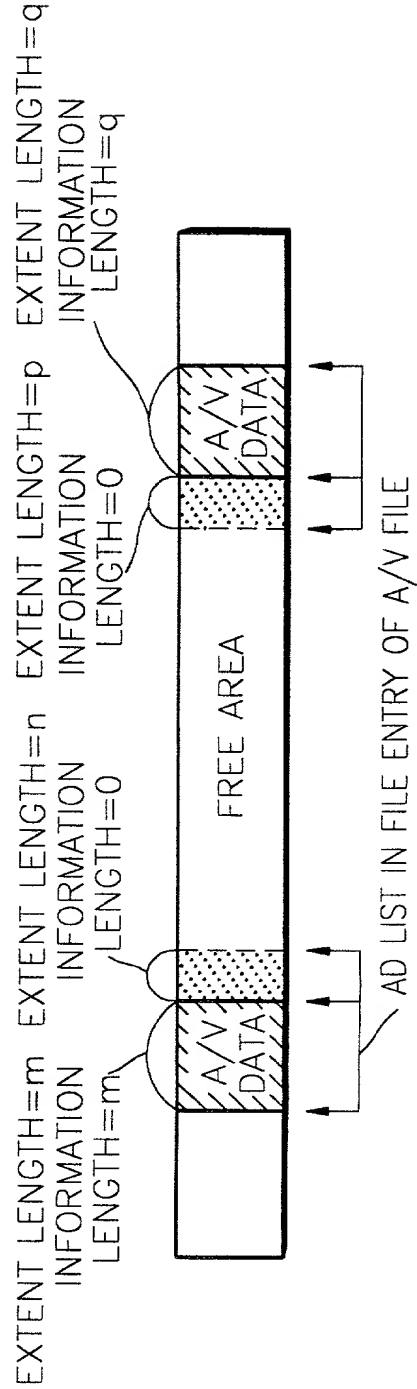


FIG. 14C

## COMBINED DECLARATION/POWER OF ATTORNEY FOR UTILITY/DESIGN PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

RECORDING MEDIUM FOR STORING REAL TIME RECORDING/REPRODUCTION INFORMATION, METHOD AND APPARATUS FOR RECORDING AND REPRODUCING IN REAL TIME, AND FILE OPERATING METHOD USING THE SAME

the specification of which is attached hereto, unless the following box is checked:

■ was filed on May 3, 1999 as United States Application Number or PCT International Application Number 09/304,279 and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56.

I hereby claim foreign priority benefit(s) under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

<u>98-15769</u>	<u>Korea</u>	<u>1/May/1998</u>	<input type="checkbox"/>
(Number)	(Country)	Day/Month/Year Filed	
<u>98-27308</u>	<u>Korea</u>	<u>7/July/1998</u>	<input type="checkbox"/>
(Number)	(Country)	Day/Month/Year Filed	
<u>98-30218</u>	<u>Korea</u>	<u>27/July/1998</u>	<input type="checkbox"/>
(Number)	(Country)	Day/Month/Year Filed	
<u>98-41764</u>	<u>Korea</u>	<u>2/October/1998</u>	<input type="checkbox"/>
(Number)	(Country)	Day/Month/Year Filed	
<u>98-55039</u>	<u>Korea</u>	<u>15/December/1998</u>	<input type="checkbox"/>
(Number)	(Country)	Day/Month/Year Filed	

I hereby claim the benefit under 35 U.S.C. § 120 or § 119(e) of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application Serial No.) (Filing Date) (Status -- patented, pending, abandoned)

I hereby appoint the following attorneys and agent to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: James D. Halsey, Jr., 22,729; Harry John Staas, 22,010; David M. Pitcher, 25,908; John C. Garvey, 28,607; J. Randall Beckers, 30,358; William F. Herbert, 31,024; Richard A. Gollhofer, 31,106; Mark J. Henry, 36,162; Gene M. Garner II, 34,172; Michael D. Stein, 37,240; Paul I. Kravetz, 35,230; Gerald P. Joyce, III, 37,648; Todd E. Marlette, 35,269; George N. Stevens, 36,938; Michael C. Soldner, 41,455; Norman L. Ourada, 41,235; Kevin R. Spivak, 43,148; Deborah S. Gladstein, 43,636; Jon H. Muskin, 43,824; and William M. Schertler, 35,348 (agent)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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■ Additional inventors are being named on separately numbered sheet(s) attached hereto.

11/98

UNITED STATES

Docket No.: 1293.1069

COMBINED DECLARATION/POWER OF ATTORNEY FOR UTILITY/DESIGN PATENT APPLICATION

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Ninth Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Residence \_\_\_\_\_ Citizenship \_\_\_\_\_

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Full name of tenth joint inventor, if any \_\_\_\_\_

Tenth Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

Residence \_\_\_\_\_ Citizenship \_\_\_\_\_

Post Office Address \_\_\_\_\_